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NUCLEAR SCIENCE ABSTRACTS

Vol. 6, No. 8, April 30, 1952

TABLE OF CONTENTS

Category	Abstract	Page
REPORTS REFERENCE LIST		iii
GENERAL	2243	285
Research Programs	2243	
BIOLOGY AND MEDICINE	2245	285
Radiation Effects	2249	
Radiation Hazards and Protection	2268	
Radiation Sickness	2273	
Radiotherapy	2274	
Toxicology Studies	2279	
Tracer Applications	2283	
CHEMISTRY	2294	291
Analytical Procedures	2308	
Crystallography and Crystal Structure	2314	
Deuterium and Deuterium Compounds	2317	
Fluorine and Fluorine Compounds	2320	
Graphite	2324	
Laboratories and Equipment	2326	
Radiation Chemistry	2327	
Radiation Effects	2329	
Rare Earths and Rare-earth Compounds	2333	
Separation Procedures	2340	
Spectroscopy	2345	
Syntheses	2348	
Tracer Applications	2350	
Transuranic Elements and Compounds	2351	
Tritium and Tritium Compounds	2352	
Uranium and Uranium Compounds	2354	
Waste Disposal	2355	
ENGINEERING	2356	299
Heat Transfer and Fluid Flow	2359	
Radiography	2366	
Vacuum Systems	2367	
Waste Disposal	2368	
MINERALOGY, METALLURGY, AND CERAMICS	2370	301
Corrosion	2371	
Geology and Mineralogy	2372	
Metals and Metallurgy	2373	
PHYSICS	2385	303
Astrophysics	2389	
Cosmic Radiation	2390	
Crystallography and Crystal Structure	2410	
Electrons	2412	
Gases	2413	
Instruments	2414	
Isotopes	2418	
Isotope Separation	2419	
Mass Spectrography	2420	
Mathematics	2424	
Measuring Instruments and Techniques	2427	
Mesons	2448	
Nuclear Physics	2460	
Nuclear Properties	2464	
Nuclear Reactors	2481	
Nuclear Transformation	2483	
Particle Accelerators	2498	
Radiation Absorption and Scattering	2503	
Radiation Effects	2520	
Radioactivity	2522	
Spectroscopy	2540	
Theoretical Physics	2543	
AUTHOR INDEX		INDEX-1
NUMERICAL INDEX OF REPORTS		INDEX-5
NEW NUCLEAR DATA		SUPPLEMENT-1

REPORTS REFERENCE LIST

Vol. 6, No. 8

The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

U. S. ATOMIC ENERGY COMMISSION UNCLASSIFIED REPORTS

AECU-1889 2356
Engineering Research Inst., Mich. Univ.
PROGRESS REPORT NO. 2; UTILIZATION OF THE GROSS FISSION PRODUCTS, by L. E. Brownell, L. C. Anderson, H. H. Gomberg, J. J. Martin, W. W. Meinke, R. B. Morrison, L. Thomassen, E. T. Vincent, R. A. Wolfe, and G. J. Van Wylen. Jan. 31, 1952. 123p. (AECU-1889; Progress Report No. 2)

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Oak Ridge National Lab.
STOPPING OF FISSION FRAGMENTS IN GASES, by E. C. Campbell, W. M. Good, and W. A. Strauser. [nd] 15p. (AECU-1891)

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Knolls Atomic Power Lab.
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Oak Ridge National Lab.
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Oak Ridge National Lab.
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Oak Ridge National Lab.
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Oak Ridge National Lab.
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Cancer Research Inst., New England Deaconess Hospital, Boston
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Knolls Atomic Power Lab.
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Argonne National Lab.
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[Argonne National Lab.]
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[Argonne National Lab.]
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[Argonne National Lab.]
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[Argonne National Lab.]
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[Argonne National Lab.]
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Argonne National Lab.
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Argonne National Lab.
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Iowa State Univ.
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Wisconsin Univ.
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Institute for the Study of Rate Processes, Univ. of Utah
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Brookhaven National Lab.
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COO-85 2379
Dow Chemical Co.
BIENNIAL REPORT (December 1, 1949 - November 30, 1951); PREPARATION OF HIGH PURITY MAGNESIUM AND A STUDY OF THE EFFECT OF NON-METALLIC AND ALKALI METAL IMPURITIES ON THE CORROSION CHARACTERISTICS OF PURE MAGNESIUM. [nd] 94p. (COO-85)

CU-100 2468
Nuclear Physics Lab., Columbia Univ.
PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER, 1951 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Feb. 28, 1952. 28p. (CU-100)

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Hanford Works
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Ames Lab.
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Ames Lab.
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Knolls Atomic Power Lab.
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North American Aviation, Inc.
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Columbia Univ.
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Carnegie Inst. of Tech.
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Carnegie Inst. of Tech.
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Pittsburgh Univ.
PROGRESS LETTER FROM OCTOBER 1, 1951 TO DECEMBER 31, 1951, by Robert Levine, John H. Wotiz,

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NYO-3036 2449
Rochester Univ.
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Rochester Univ.
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Rochester Univ.
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Rochester Univ.
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Columbia Univ.
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Columbia Univ.
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New Hampshire Univ.
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Johns Hopkins Univ.
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ORNL-1117 2327
Oak Ridge National Lab.
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Oak Ridge National Lab.
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ORO-59 2287
Tennessee Univ.
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SO-3500 2340
Rensselaer Polytechnic Inst.
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TID-3022 2359
Technical Information Service, AEC
HEAT TRANSFER; A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Alan T. Morphew, comp. Mar. 18, 1952. (TID-3022)

TID-5076 2374
Battelle Memorial Inst.
NOTES FROM THE CONFERENCE ON URANIUM METALLOGRAPHY AT BATTELLE MEMORIAL INSTITUTE ON JULY 10, 1949, by R. F. Dickerson. Feb. 7, 1952. 19p. (TID-5076)

UCLA-186 2414
California Univ., Los Angeles
AN AUTOMATIC GEIGER-MUELLER TUBE TESTER, by George H. Streit and W. R. Kennedy. Issued Feb. 28, 1952. 10p. (UCLA-186)

UCLA-187 2269
Atomic Energy Project, Univ. of Calif., Los Angeles
THE VALUE OF GAMMA RADIATION DOSIMETRY IN ATOMIC WARFARE INCLUDING A DISCUSSION OF PRACTICAL DOSAGE RANGES, by George V. Taplin. Issued Mar. 6, 1952. 20p. (UCLA-187)

UCRL-1650 2448
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 29, 1951, by S. Shewchuck. Jan. 24, 1952. 12p. (UCRL-1650)

UCRL-1651 2491*
Radiation Lab., Univ. of Calif.
INDEX TO INFORMATION AVAILABLE ON THE 60-INCH CROCKER CYCLOTRON. Jan. 7, 1952. 10p. (UCRL-1651)

UCRL-1656 2498
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF DECEMBER 13, 1951, by Sergey Shewchuck. Feb. 11, 1952. 6p. (UCRL-1656)

UCRL-1657 2328
Radiation Lab., Univ. of Calif.
RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS CONTAINING BOTH FERROUS ION AND CARBON DIOXIDE, by Warren M. Garrison and G. K. Rollefson. Jan. 28, 1952. 15p. (UCRL-1657)

UCRL-1659 2288
Radiation Lab., Univ. of Calif.
TURNOVER RATE STUDIES ON NUCLEIC ACIDS, by Anita H. Payne, Lola S. Kelly, and Hardin B. Jones. Feb. 6, 1952. 45p. (UCRL-1659)

UCRL-1660 2450
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF JANUARY 3, 1952, by Sergey Shewchuck. Feb. 12, 1952. 9p. (UCRL-1660)

UCRL-1665 2483
Radiation Lab., Univ. of Calif.
THE PHOTO-DISSOCIATION OF THE HELIUM NUCLEUS BY HIGH ENERGY GAMMA RAYS, by Seishi Kikuchi. Feb. 1, 1952. 5p. (UCRL-1665)

UCRL-1671 2525
Radiation Lab., Univ. of Calif.
NICKEL 56, by W. J. Worthington, Jr. Feb. 6, 1952. 4p. (UCRL-1671)

UCRL-1673 2506
Radiation Lab., Univ. of Calif.
THE ELASTIC SCATTERING OF PROTONS FROM HELIUM 4, by Bruce Cork. Feb. 11, 1952. 10p. (UCRL-1673)

UCRL-1674 2416
Radiation Lab., Univ. of Calif.
PULSE TRANSFORMERS DESIGN; 300 KV IN 1/10 OF A MICROSECOND, by Robert E. Heller. Feb. 1952. 19p. (UCRL-1674)

UCRL-1675 2428
Radiation Lab., Univ. of Calif.
RESOLVING TIME OF THE SCINTILLATION COUNTER, by R. F. Post. Radiation Lab., Univ. of Calif. and Stanford Univ. Feb. 14, 1952. 11p. (UCRL-1675)

UCRL-1677 2415
Radiation Lab., Univ. of Calif.
A VOLTAGE INTEGRATOR FOR MAGNETIC FIELD MEASUREMENTS, by L. Jones and J. W. Rose. Feb. 13, 1952. 23p. (UCRL-1677)

UR-200 2279
Atomic Energy Project, Univ. of Rochester
QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1951 THRU DECEMBER 31, 1951. Feb. 11, 1952. 59p. (UR-200)

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

AERE C/R-796 2309
Atomic Energy Research Establishment, Harwell, Berks (England)
THE ANALYSIS OF COBALT-URANIUM ALLOYS, by G. W. C. Milner and R. Macara. Oct. 22, 1951. 9p. (AERE C/R-796)

AERE G/M-96 2367
Atomic Energy Research Establishment, Harwell, Berks (England)
"O" RING SEALED VACUUM VALVES, by P. A. Shatford. Aug. 28, 1951. 4p. (AERE G/M-96)

AERE M/M-35 2314
Atomic Energy Research Establishment, Harwell, Berks (England)
A SIMPLE DEVICE FOR OBTAINING X-RAY DIFFRACTION PATTERNS FROM COARSE-GRAINED MATERIALS, by R. W. Cahn and T. W. Baker. [nd] 5p. (AERE M/M-35)

AD-336(B) 2246
Naval Radiological Defense Lab.
EFFECT OF ACTH, CORTISONE AND ADRENALECTOMY ON PLASMA SULFHYDRYL AND PROTEIN LEVELS (Final Report), by Bernard Shacter and Cecil Entenman. Jan. 7, 1952. 14p. (AD-336(B); U21143)

AF-TR-6581 2424*
Wright Air Development Center
A NEW LINEAR OPERATIONAL CALCULUS, by Frank W. Bubb. May 1951. 41p. (AF-TR-6581)

AF-TR-6601(pt.1) 2300
American Electro Metal Corp.
AN INVESTIGATION OF THE ALLOYS OF ALUMINUM AND MOLYBDENUM, by R. L. Wachtell. 49p. (AF-TR-6601 (pt.1))

LT-21 2503*
Atomic Energy Project (Canada)
THE SCATTERING OF NEUTRONS BY BOUND PROTONS AND CRYSTALS, by H. H. Clayton. Summer 1947. 71p. (LT-21; NRC-2393)

NBS-1076 2435
National Bureau of Standards
METHOD AND INSTRUMENT FOR THE MEASUREMENT OF MICROPHONIC EFFECTS IN MICROWAVE TUBES, by Guy F. Barnett. April 2, 1951. 7p. (NBS-1076; U20736)

NP-3117 2425*
Massachusetts Inst. of Tech.
APPROXIMATE ANALYTICAL METHODS FOR DETERMINING NATURAL MODES AND FREQUENCIES OF VIBRATION, by J. W. Siddall and G. Isakson. Jan. 16, 1951. 186p. (NP-3117)

NP-3158 2377*
Illinois Inst. of Tech.
THE REACTIONS OF METALS WITH GASES AND SALTS AT HIGH TEMPERATURES; THE OXIDATION OF SILICON AT HIGH TEMPERATURES, by Merwyn B. Brodsky and Daniel Cubicciotti. Aug. 1950. 13p. (NP-3158; Technical Report No. 8; U13884)

NP-3162 2254*
Naval Medical Research Inst., Bethesda
ORAL MANIFESTATIONS OF IONIZING RADIATION; I. ORAL LESIONS AND EFFECT ON DEVELOPING TEETH OF SWINE EXPOSED TO 2000 K.V. TOTAL BODY X-RADIATION, by James A. English and John L. Tullis. Dec. 29, 1950. 38p. (NP-3162; U17518)

NP-3597 2485
Catholic Univ. of America
FINAL REPORT ON NUCLEAR RESEARCH, by F. L. Talbott, A. Busala and G. C. Weiffenbach. July 1951. 15p. (NP-3597; Technical Report No. 2; U20705)

NP-3598 2410
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
A STUDY OF ORGANIC SCINTILLATORS, by Raymond C. Sangster. Jan. 1, 1952. 109p. (NP-3598; Technical Report No. 55; U20735)

NP-3614 2345
Duke Univ.
QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; AUGUST 1, 1951 - NOVEMBER 1, 1951, by Walter Gordy. [nd] 68p. (NP-3614; U17991)

NP-3625 2299
Louisiana State Univ.
THEORY OF KINETIC POLAROGRAPHIC CURRENTS AND CONVERSION OF RATE CONSTANTS, by Paul Delahay. Jan. 1952. 13p. (NP-3625; Technical Report No. 5; U20833)

NP-3626 2341
Louisiana State Univ.
THEORY OF CATALYTIC POLAROGRAPHIC CURRENTS, by Paul Delahay and George L. Stiehl. Dec. 1951. 26p. (NP-3626; Technical Report No. 4; U20832)

NP-3630 2322
Minnesota Mining and Manufacturing Co.
ANNUAL PROGRESS REPORT NO. 2; MAY, 1950 TO MAY, 1951, by W. H. Pearlson. [nd] 76p. (NP-3630; Annual Progress Report No. 2; ATI-119351)

NP-3633 2311
Arkansas Univ.
ELECTROSTATICS OF REACTIONS FROM COULOMBIC ENERGIES AND THE ARRHENIUS EQUATION, by Edward S. Amis. Feb. 8, 1952. 12p. (NP-3633; Technical Report No. 1; U20865)

NP-3643 2342
Wisconsin Univ.
ADDITION COMPOUNDS OF ZIRCONIUM AND HAFNIUM TETRACHLORIDES WITH PHOSPHORUS OXYHALOGEN COMPOUNDS, by Edwin M. Larsen, John Howatson, Adrian M. Gammill and Layton Wittenberg. Jan. 31, 1951. 13p. (NP-3643; Technical Report III)

NP-3667 2256
Naval Medical Research Inst., Bethesda
THE PROGRESSION OF MORPHOLOGIC LESIONS IN SWISS MICE EXPOSED TO 625 r, 2000 KVP, TOTAL BODY X-RADIATION, by Baldwin G. Lamson and John L. Tullis. July 31, 1951. 27p. (NP-3667; R6089)

NRC-2407 2366
National Research Council of Canada
IRIDIUM 192 FOR GAMMA RAY RADIOGRAPHY, by Adair Morrison. Feb. 20, 1951. 11p. (NRC-2407)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 April 30, 1952 No. 8

GENERAL

RESEARCH PROGRAMS

2243

ELEVENTH SEMIANNUAL REPORT OF THE ATOMIC ENERGY COMMISSION; SOME APPLICATIONS OF ATOMIC ENERGY IN PLANT SCIENCE. Washington, D. C., U. S. Government Printing Office, Jan., 1952. 211p.

Major activities in atomic energy programs from July to Dec. 1951 are described briefly under the following headings: raw materials, production, AEC community operations, construction and supply, military application, reactor development, physical research, biology and medicine, legislative proposals, patents, technical information services, and organization and personnel. Part II is a condensed AEC financial report for the fiscal year 1951. Atomic energy and its applications in plant science are discussed rather extensively in Part III with respect to effects of radiation on plants, plant research with isotopes, and photosynthesis and biosynthesis. Several appendices cover publications and regulations of AEC, committee memberships, isotope distributions, etc.

2244

THE SCIENTIFIC WORK OF THE ATOMIC ENERGY RESEARCH ESTABLISHMENT. John Cockcroft. *Proc. Phys. Soc. (London)* *211A*, 155-68(1952) Feb. 21.

The research program at Harwell is discussed in general, and a few representative experiments are explained briefly. The following fields of study receive separate attention: radioactive isotope production, production and use of separated stable isotopes, chemical and chemical engineering research, metallurgy research, and reactor physics and engineering. Photographs of some of the buildings and equipment at Harwell are shown.

BIOLOGY AND MEDICINE

2245

Oak Ridge National Lab.

THE EFFECT OF VARIOUS ENZYMES ON NUCLEI ISOLATED FROM RAT LIVER (Abstract), by Norman G. Anderson. [nd] 1p. (AECU-1897)

Desoxyribonuclease, when added to freshly isolated nuclei, caused rapid loss of density and a virtual empty appearance under the phase microscope, condensation of the nucleoli into granular masses which often exhibited restricted Brownian movement, a slight decrease in nuclear diameter, and sharper definition of the nuclear envelope. In contrast ribonuclease caused only rapid (30 sec.) condensation of the nucleoli into small dense bodies. Treatment with both nucleases resulted in the formation of numerous intranuclear granules in rapid Brownian movement. Proteases (trypsin and chymotrypsin) caused rapid nuclear disintegration with swelling of the DNA gel and rupture of the nuclear envelope. (The enzymes were used in a concentration of 1 mg/ml in a phosphate-bicarbonate buffer at pH 7.1.) These observations together with the results of previous studies are taken to indicate that the envelope of the isolated liver cell nucleus is a porous structure which allows free passage of a number of high molecular weight substances. The results do not support the theory that the nuclear envelope is composed solely of the chromosomal sheaths of swollen or extended chromosomes. (Entire report. Abstract of paper for Atlanta meeting of Association of Southeastern Biologists, April 18-19, 1952.)

2246

Naval Radiological Defense Lab.

EFFECT OF ACTH, CORTISONE AND ADRENALECTOMY ON PLASMA SULFHYDRYL AND PROTEIN LEVELS (Final Report), by Bernard Shacter and Cecil Entenman. Jan. 7, 1952. 14p. (AD-336(B); U21143)

ACTH and cortisone had no effect on plasma sulfhydryl (I) or protein levels when administered to intact male rats. ACTH administered to laparotomized male rats partially prevented the fall in I concentration which follows tissue injury. Similar decreases in I levels were observed following either sham operation or adrenalectomy. After adrenalectomy, there was a significant fall in the plasma protein concentration of female, but not of male, rats. The normal sex difference in serum protein concentration may be exaggerated by adrenalectomy. (cf. TIP U20409) (NRS abst.)

2247

Brookhaven National Lab.

DISTRIBUTION AND BEHAVIOR OF SUPERNUMERARY CHROMOSOMES DURING MICROSPOROGENESIS IN A POPULATION OF *TRILLIUM ERECTUM* L., by Arnold H. Sparrow, Virginia Pond and Rhoda C. Sparrow. [nd] 28p. (BNL-1082)

Two hundred and thirty-seven *Trillium erectum* were examined cytologically at first metaphase. Forty-four (18.6%) were found to have from one to four supernumerary chromosomes. Characteristics observed from a detailed study of the behavior of the supernumeraries are reported.

2248

[Tennessee Valley Authority]

THE SECOND FALL ESTIMATE OF THE SIZE OF THE FISH POPULATION OF WHITE OAK LAKE, by Louis A. Krumholz and William T. Miller. Sept.-Oct. 1951. 10p. (ORO-57)

RADIATION EFFECTS

2249

Oak Ridge National Lab.

EFFECTS OF BETA RAYS AND X RAYS ON MITOTIC RATE OF LIVING GRASSHOPPER NEUROBLASTS (abstract), by Mary Esther Gaulden, Marjorie Nix, and Edgar B. Darden, Jr. [nd] 1p. (AECU-1896)

Fourteen-day-old embryos of *Chortophaga viridifasciata* were removed from eggs and dissected as for hanging drop preparations. Some were exposed to 1.7-Mev beta rays from P^{32} and some to 125-kvp x rays, conditions for exposure being identical in both cases (Gaulden, Sheppard, and Cember, *Nature* *169*, 228(1952)). Two doses of radiation were used, namely, 8 r and 64 r of x rays and 8.8 rep and 70.4 rep of beta rays — dose rates were adjusted so that the amount of energy dissipated in the tissue at a given dose level would be the same for both types of radiation. The irradiated and control embryos were made into hanging drop preparations following irradiation and the neuroblasts observed with a microscope enclosed in an incubator maintained at 38°C. The number of cells in mid-mitosis (prometaphase, metaphase, and anaphase) was recorded every 22 minutes for 6 hours. Twenty-two minutes is the average duration of mid-mitosis and the doses of radiation used do not affect it, consequently, the number of cells going through mitosis in a given period of time can be determined. At both doses x rays and beta rays affect mitotic activity similarly with respect to the extent to which it is depressed but differently with respect to recovery—a greater number of cells recover after treatment with beta rays than with x rays. This difference in recovery is statistically significant at the 0.02 level. (Entire Report. Abstract of paper for Atlanta meeting of Association of Southeastern Biologists, April 18-19, 1952)

2250
Oak Ridge National Lab.
FRAGMENTATION OF CHROMOSOMES IN GRASSHOPPER NEUROBLASTS BY BETA RAYS AND X RAYS (abstract), by Mary Esther Gaulden, Katherine Loemker, and Edgar B. Darden, Jr. [nd] 1p. (AECU-1898)

Dissected fourteen-day-old embryos of Chortophaga viridifasciata were exposed to 1.7 Mev beta rays from P^{32} and some to 125 kvp x rays, conditions for exposure being identical in both cases. A dose of 64 r of x rays and 70.4 rep of beta rays was used, the amount of energy dissipated in the tissue being equal for the two types of radiation. The embryos were made into hanging drop preparations following irradiation and placed at 38°C. At intervals of 44, 220, 264, and 352 minutes after irradiation the embryos were fixed and stained. Cells in late anaphase and very early telophase were examined for chromosome fragments (single and double). The number of cells with fragments and the number of single fragments produced were the same in both x-rayed and beta-irradiated cells. The number of beta ray induced double fragments observed in cells fixed 352 minutes after irradiation, however, was greater than the number observed in x-rayed cells fixed at the same interval. This difference was statistically significant at the 0.02 level. Since the mitotic rate of beta irradiated cells differs from that of x-rayed cells, the difference observed in frequency of double fragments may be due to the fact that cells analyzed 352 minutes after irradiation were treated in different stages of mitosis and not due to a difference in effectiveness of the two types of radiation in producing fragments at one stage of mitosis. (Entire Report. Abstract of paper for Atlanta meeting of Association of Southeastern Biologists, April 18-19, 1952)

2251
Pittsburgh Univ.
RADIOSENSITIVE AND RADIORESISTANT PHASES IN THE ANTIBODY RESPONSE, by Frank J. Dixon, David W. Talmage, and Paul H. Maurer. [nd] 15p. (AECU-1919)

The inhibitory effect of radiation on antibody response was shown to be dependent upon radiation-induced changes prior to the administration of antigen. Whole-body radiation given simultaneously with, or six hours after, injection of I^{131}-labeled bovine gamma globulin had little effect on antibody response in rabbits. Response decreased until none was detectable when radiation was given 48 hr before the antigen. Certain postulations are made concerning response of antibody formation to radiation.

2252
Cancer Research Inst., New England Deaconess Hospital, Boston
SOME CYTOLOGIC AND HISTOCHEMICAL STUDIES OF RADIATION REACTION, by Shields Warren, Margaret W. Holt, and Sheldon C. Sommers. [nd] 10p. (AECU-1902)

Cytologic and histochemical investigations of frozen-dried dry-mounted animal tissues exposed to ionizing radiations are reported. Radiosensitive cells developed prominent intranuclear vacuoles with lethal rupture of nuclear membranes. Radioresistant cells remained viable, and formed small intranuclear vacuoles which were extruded. Stains for desoxyribose nucleic acids showed post-irradiation loss proportional to radiosensitivity. Among four so-called radiomimetic chemicals tested, only colchicine closely simulated effects of radiation. (auth)

2253
Massachusetts Inst. of Tech.
A CRITICAL EVALUATION OF THE LITERATURE PERTAINING TO THE APPLICATION OF IONIZING RADIATIONS TO THE FOOD AND PHARMACEUTICAL FIELDS, by Bernard E. Proctor and Samuel A. Goldblith. Jan. 1, 1952. 242p. (NYO-3337; Technical Report No. 1)

A critical evaluation is given of the literature that has been published concerning fundamental and applied research in the many phases of the application of ionizing radiations to the food, tissue, and pharmaceutical fields. The report is not intended to be a complete survey of the literature in these fields but rather to be a survey of the important information available in the literature, properly evaluated from the experience of the writers, that will serve as a basis for planning the research program at the Massachusetts Institute of Technology on the utilization of fission by-products for preservation purposes.

2254
Naval Medical Research Inst., Bethesda
ORAL MANIFESTATIONS OF IONIZING RADIATION; I. ORAL LESIONS AND EFFECT ON DEVELOPING TEETH OF SWINE EXPOSED TO 2000 K.V. TOTAL BODY X-RADIATION, by James A. English and John L. Tullis. Dec. 29, 1950. 38p. (NP-3162; U17518)

Oral tissues, salivary glands, and developing teeth of 41 young swine were studied grossly and histologically for pathologic changes resulting from x-irradiation doses of 250 to 800 r. Gross changes in the oral mucosa consisted of petechial and ecchymotic hemorrhages in 49% and marked ulceration in 9.8% of the animals. Irregular erosions of the mucosa occurred in about 30% and either petechial or massive hemorrhage was evident around the developing teeth of 70% of the animals. Regional lymph modes showed a high degree of sensitivity to x irradiation by exhibiting hemorrhage and depletion of lymphoid cells. Salivary glands were among the less sensitive tissues with regard to morphologic change; however, a decrease of basic staining granules was observed in acute stages of radiation sickness, with complete recovery in 30-day survivors. A characteristic type of hypoplasia of the enamel of developing molar teeth was observed among the swine which received more than 400 r. Ameloblasts which were actively producing enamel matrix appeared to be sensitive to irradiation. Other portions of the teeth showed minimal effects. (auth)

2255
Brookhaven National Lab.
THE PROTECTIVE EFFECT OF GLUTATHIONE AGAINST RADIATION INDUCED CHROMOSOME ABERRATIONS, by Knut Mikaelsen. [nd] 8p. (BNL-1111)

Cuttings of Tradescantia paludosa were grown in solutions of different concentrations of reduced glutathione during a 48-hour exposure to continuous gamma-radiation from a 3-curie Co^{60} source at a dose of 25 r per day. The results illustrated clearly that there was a positive correlation between increased glutathione concentrations and decreased fragment frequency between 1×10^{-5} and 3×10^{-4} M. The latter concentrations reduced the number of fragments produced to about 50 per cent of that in the irradiated controls. (auth)

2256
Naval Medical Research Inst., Bethesda
THE PROGRESSION OF MORPHOLOGIC LESIONS IN SWISS MICE EXPOSED TO 625 r, 2000 KVP, TOTAL BODY X-RADIATION, by Baldwin G. Lamson and John L. Tullis. July 31, 1951. 27p. (NP-3667; R6089)

One thousand Swiss male mice were exposed to 625 r, 2000 kv total-body x radiation. Nine hundred ninety of these mice were sacrificed serially, ten mice each hour for the succeeding 99 hours. Microscopic studies of the spleen, lymphoid tissue, bone marrow, intensities, liver and testes were made to observe the tissue response to this injury. Damage to lymphocytes, immature erythropoietic tissue and selected epithelial cells of the small bowel mucosa was observed one hour after exposure. Reduction of cellularity of myeloid tissue occurred more gradually. Damage to lymphoid tissue reached a peak between 7 and 12 hours, and regeneration was generally evident by 60 hours. Erythropoietic tissue could not be found after 14 hours, yet regeneration was seen sporadically between 66 and 99 hours. Peak injury to small bowel mucosa extended over the 8 to 32 hour period, whereas repair was completed by 60 hours after radiation exposure. Complete repair of lymphoid, erythropoietic and myeloid tissue did not occur during the 99 hours observation period. Mitotic activity was reduced for a period following irradiation in all organs studied with the exception of the testes. Selective damage to spermatogonia of the testes was not seen during the period of this study. (auth)

2257
MYXEDEMA IN THE RADIOTHYROIDECTOMIZED DOG. R. C. Goldberg and I. L. Chaikoff. Endocrinology 50, 115-23(1952) Jan.

Twelve dogs were injected with various doses of I^{131} and sacrificed at intervals of 1 to 12 months later. In 6 of these dogs, all thyroid tissue had been destroyed by the ionizing radiation. Myxedema and behavioral changes characteristic of hypothyroidism were observed in 2 of the 3 completely thyroidectomized dogs kept for one year after the injection. The following other changes were observed in completely thyroidectomized dogs: an increase in the acid polysaccharide content of skin; hyperkeratosis and epidermal atrophy of skin; anemia; increased liver fat; muscle degeneration; lymph node involution; and atrophy of gastrointestinal tract. "Thyroidectomy cells" were found in the anterior pituitary of both subtotally and totally thyroidectomized dogs. Alpha cell degranulation was found in only the totally thyroidectomized animal. Radiation damage to the parathyroids and trachea was insignificant in all I^{131}-treated dogs. (auth)

2258
EFFECT OF ROENTGEN RADIATION ON THYROID FUNCTION IN RATS. John B. Hursh, Priscilla A. Van Valkenburg, and John B. Moheny. Radiology 56, 411-18(1951) Sept.

Rats were irradiated by x rays applied locally to the thyroid area at total dose levels of 3000, 4500, and 6000 r. Thyroid function was tested by injecting I^{131} at various intervals after irradiation, sacrificing the animals four hours after injection, and analyzing the excised thyroid gland for uptake of I^{131}, as well as the percentage of I^{131} bound in an undialyzable complex. Histologic sections of the thyroids were prepared and examined. In the rats receiving 3000 r and 6000 r the iodine uptake was greater than in the control rats, and the increase was greater the higher the x-ray dose and the longer the post-irradiation interval within the limits investigated. In spite of the increased iodine uptake, no morphological changes of the thyroids could be found at these dose levels on the basis of examination of random sections. The increased uptake is tentatively regarded as an indirect consequence of a systemic response to radiation. The level of local X irradiation necessary to produce destruction of thyroid tissue is greater than the highest dose (about 5000 r delivered as a single dose) which can be administered to a rat without causing its death. (auth)

2259
PHYSICAL ASPECTS OF THE BIOLOGICAL ACTION OF IONIZING RADIATIONS. John Read. Brit. J. Applied Phys. 2, 337-45(1951) Dec.

The influence of such physical factors as the linear ion density created by different radiations, the presence of dissolved oxygen or certain other molecules, and the dose rate, on the production of biological effects by ionizing radiations is discussed. Certain radiochemical experiments are outlined which show similarities with radiobiological experiments. Hypotheses are suggested which attempt to correlate and explain some of the biological observations. (auth)

2260
DIFFUSION AND RECOMBINATION OF PRODUCTS OF IONIZING RADIATIONS. I. Opatowski and F. R. Tangherlini. Bull. Math. Biophys. 13, 273-88(1951) Dec.

The relative importance of diffusion and recombination of the products of ionizing radiations is examined in several typical cases and methods for the solution of the differential equation of columnar ionization are discussed. It is shown that Jaffé's method is not applicable to radiobiological or purely radiochemical processes in which no external electric fields are acting. A method based on a recent suggestion of Kramers appears to be particularly good when recombination is strong. (auth)

2261
DETERMINATION OF THE SENSITIVE VOLUME BY IRRADIATION AND THE IONIZATION DENSITY. I. Opatowski. Bull. Math. Biophys. 13, 263-71(1951) Dec.

Lea's formula for the determination of size of the sensitive volume is corrected and applied to experiments on inactivation of the tobacco mosaic virus using three different wave lengths of x rays. The purely geometric concept of the sensitive volume is not sufficient for explaining the known dependence of the inactivation of this virus on wave length. The concept of transfer of energy around the ionizing particles is discussed in this connection in a manner similar to that suggested by Pollard and Forro for the inactivation of the T − 1 phage, and results similar to those given by these authors are obtained from an analysis of the inactivation data of J. W. Gowen (tobacco mosaic virus). Differences of interpretation of these two sets of experiments carried out with different types of radiation are pointed out. (auth)

2262
AN ANALYSIS OF SEEDLING MUTANTS (SPONTANEOUS, ATOMIC BOMB-RADIATION-, and X RAY-INDUCED) IN BARLEY AND DURUM WHEAT. C. C. Moh and Luther Smith. Genetics 36, 629-40(1951) Nov.

The study involved atomic bomb- and X ray-induced, and spontaneous seedling mutants in barley and durum wheat. Progeny tests were made of 650 X_2 plants, representing 397 independent mutants; and of 5,653 X_3 plants, representing 581 mutants. It was concluded that chromosomal aberrations (possibly deficiencies) associated with a considerable portion of the mutations, or pleiotropic effects of the mutant genes, best accounted for the fact that over 20 percent of the mutants tested segregated in ratios that deviated significantly from the theoretical 3 : 1. The results could readily be accounted for if it were assumed that a considerable portion of the mutations were in fact deficiencies rather that gene or "point" mutations — an hypothesis which is being checked by further tests. (auth)

2263
EFFECTS ON THE WHITE MOUSE OF A SINGLE WHOLE-BODY EXPOSURE TO 190 MEV DEUTERONS. Paul D. Rosahn, Cornelius A. Tobias, and John H. Lawrence. Am. J. Path. 28, 37-49(1952) Jan.-Feb.

White mice were exposed to a single whole-body irradiation by the deuteron beam of the 184-inch cyclotron in doses of 3.8×10^4, 7.5×10^4, and 14.9×10^4 ergs/g. Studies of the peripheral blood showed a prompt and significant reduction in the total white count, and in the absolute number of neutrophils and lymphocytes. A slightly delayed but marked reduction in platelets also occurred. Surviving animals which received the smallest exposure showed a return of these blood elements to normal levels by the 18th day. Following exposure to 190-Mev deuterons, severe aplasia was noted in bone marrow. Lymph nodes and spleen showed focal cellular necrosis, macrophage proliferation, and loss of cellular constituents. The blood and tissue changes after whole body exposure to the deuteron beam were proportional to the roentgen equivalent doses, and similar to the changes known to occur following other types of ionizing irradiation. (auth)

2264
GRENSSTRALEN-REACTIES EN DE AETIOLOGIE VAN DE RÖNTGENKATER (GRENZ-RAY REACTIONS AND THE ETIOLOGY OF ROENTGEN-RAY SICKNESS). Piet Dethmers. Apeldoorn, Netherlands, W. de Wekker, 1950. 320p. (In Dutch)

Observations on 50 patients treated with Grenz or Bucky rays, usually with 800 to 1000 r, and subsequently exhibiting symptoms identical with those of x-ray sickness are reported in detail. In 35 cases the skin was irradiated, in 15 the eye. It was found that irradiation may produce, parallel with the subjective malaise symptoms and local reactions, a reaction in a certain wave rhythm which may affect numerous internal mechanisms, such as blood cells, sugar content of the blood, blood pressure, body temperature, and others. Local and general symptoms, typical of radiation sickness, are described, and the reaction wave is divided into direct, intermediate, main, and after reactions. Grenz irradiation of the eye produced a crystalline formation on the hindmost layers of the cornea. This had no effect whatever on the sight and sometimes disappeared without trace. A new theory is promulgated that considers the x-ray sickness as a defective functioning of the so-called central neuro-hormonal regulating mechanism in the diencephalon, through which regulation of the various mechanisms takes place. The adenohypophysis should be held responsible for the phenomenon of wavelike reactions. Summaries in English, French, and German are appended.

2265
QUANTITATIVE AND QUALITATIVE ANALYSIS OF ROENTGEN RAY INJURY IN DROSOPHILA EXPERIMENTS. Hedi Fritz-Niggli. Fortschr. Gebiete Röntgenstrahlen 76, 218-54(1952) Feb. (In German)

The pupa of Drosophila melanogaster represents a good subject for actinobiological and special ontogenetic experiments because tissue is found in histolysis as well as in morphologic and cytological differentiation and at rest. Irradiation of pupas of various ages (5, 15, 22, 30, 40, 50, and 72 hr) with 6000, 12,000, 36,000, and 80,000 r (50-kv, 2-ma and 180-kv, 6-ma) showed that the radiosensitivity of the chrysalis diminishes with advancing age. Detailed studies on the changes in body wall, bristle design, hypodermis, muscles, fat cells, gonads, cell differentiation, etc., are reported. 35 figures.

2266
EFFECT OF ULTRAHARD RADIATION (31-MEV-BETATRON) ON THE EGGS OF DROSOPHILA MELANOGASTER. H. R. Schinz, Hedi Fritz-Niggli, and E. Frey. Experientia 8, 16-18(1952) Jan. 15. (In German)

The following LD_{50}'s were determined for Drosophila melanogaster eggs of 3-, 4-, and 7.5-hr age, respectively: 200, 460, and 825 r for 180-kev x radiation; 200, 1225, and 1060 r for 3-Mev electrons; and 237, 1117, and 1167 r for 31-Mev x radiation. Lethal-dose curves are plotted. Reasons for the lower biological effectiveness of the hard 31-Mev radiation are discussed.

2267
THE TOLERANCE OF EPIDERMAL CELLS OF MICE TO HEAVY DOSES OF EXTERNAL ALPHA-IRRADIATION. Finn Devik. Acta Path. Microbiol. Scand. Suppl. 91, 45-7 (1951). (In English)

The histological and cytological effects of known quantities of external α irradiation on the skin of mice are compared with the effects of local x irradiation. It was concluded that the epidermis contains a number of cells which will survive doses of the order of 100,000 r of α rays. In the histological sections, x irradiation was seen to produce more pronounced changes than were produced by α-ray doses of 1 to 2 orders of magnitude above the x-irradiation dose.

RADIATION HAZARDS AND PROTECTION

2268
Hanford Works
FAST NEUTRON MONITORING OF PERSONNEL, by E. C. Watson. Aug. 1, 1951. 19p. (HW-21552)

A routine procedure of monitoring personnel for fast neutron exposures is described. The method employs NTA Nuclear Track Emulsions and is operated by nontechnical personnel with a reliability of about thirty per cent for a flux of 1.4×10^5 fast neutrons per square centimeter. (auth)

2269
Atomic Energy Project, Univ. of Calif., Los Angeles
THE VALUE OF GAMMA RADIATION DOSIMETRY IN ATOMIC WARFARE INCLUDING A DISCUSSION OF PRACTICAL DOSAGE RANGES, by George V. Taplin. Issued Mar. 6, 1952. 20p. (UCLA-187)

The general distribution and proper use of self-reading gamma radiation dosimeters by civilians and military personnel could result in a large saving of life and medical supplies during the early phases of an atomic disaster. Data and estimates are presented which indicate that comparatively few persons receiving external radiation exposures exceeding 400 r would warrant extensive medical treatment. Therefore, it is proposed that the critical r values used in personnel dosimeters be revised downward from 200-400-600 r to 100-250-400 r. These lower ranges appear adequate for medical classification purposes and are more desirable for psychological reasons. Furthermore, a 50-r range would be of added value to radiological monitors and rescue groups, by providing them with a necessary baseline upon which to operate or reorganize. The greatest value of personnel dosimetry could be its reassurance effect, thereby suppressing the fear of radiation injury in the large proportion of persons escaping visible injury, whose hysterical behavior and resultant panic might otherwise prove even more vitally catastrophic than the atomic explosion itself. 38 references. (auth)

2270
FURTHER EFFORTS TO INFLUENCE X-RAY CATARACT BY CHEMICAL AGENTS. Ludwig Von Sallmann. Arch. Ophthalmol. (Chicago) 47, 21-2(1952) Jan.

A study of the effects of treatment with cysteine upon cataract production by x radiation is reviewed.

2271
CLINICAL AND PATHOLOGICAL CHARACTERISTICS OF RADIATION CATARACT. David G. Cogan, David D. Donaldson, and Algernon B. Reese. Arch. Ophthalmol. (Chicago) 47, 55-70(1952) Jan.

The clinical features of cataract in human beings characteristic of radiation are the doughnut-shaped configuration, as seen with the ophthalmoscope, and the sharply demarcated anterior boundary of the opacity and the bivalve configuration of the opacity, as seen with the slit-lamp biomicroscope. These are not seen in all stages of radiation cataract and are not exclusively found in radiation cataract, but when present they are strongly suggestive of the radiation type and are usually sufficient to differentiate the radiation type from posterior polar cataract and cataracta complicata, with which it may easily be confused. The histologic changes of radiation cataract consist primarily of failure of the cells at the equator to differentiate into lens fibers, and early migration of cells beneath the posterior capsule toward the posterior pole. These aberrant cells may cause thickening of the capsule and undergo changes that are interpreted as abortive attempts at differentiation of lens fibers. In general, the histologic manifestations of radiation cataract are less type-specific than are the clinical signs. (auth)

2272

THE HAZARD INVOLVED IN THE USE OF CARBON-14. Howard E. Skipper. Nucleonics 10, No. 2, 40-4(1952) Feb.

The following factors are considered in this discussion of the hazards involved in using C^{14}: exchange of inhaled $C^{14}O_2$ with blood carbonate; fixation of C^{14} in tissues; turnover in blood, tissues, and bones; radiation received from C^{14} in the body; stability of inhaled $BaC^{14}O_3$ particles in the lungs; and inherent carcinogenicity of C^{14}. It is concluded that C^{14} is nonhazardous when used with caution at experimental levels.

RADIATION SICKNESS

2273

THE ACUTE RADIATION SYNDROME: A STUDY OF NINE CASES AND A REVIEW OF THE PROBLEM. Louis H. Hempelmann, Hermann Lisco, and Joseph G. Hoffman. Ann. Internal Med. 36, 279-510(1952) Feb.

Several years ago at the Los Alamos Scientific Laboratory two accidental nuclear reactions occurred which injured 10 persons. The case histories of nine of the 10 patients are presented in this report. Because there are no other examples of this type of acute radiation injury, the case histories are reported in considerable detail and the implications of the clinical and laboratory observations are discussed fully. Since these cases are unique, all pertinent data are presented in this report. Summaries are given at the end of each case history and after the discussion of the different aspects of the illness. This report is written primarily for the clinician; therefore, emphasis has been placed on the clinical, hematologic and pathologic aspects of these illnesses. In order to give the practicing physician a better understanding of the nature of the injuries, certain basic physical phenomena are described. Also, the mechanisms by means of which ionizing radiations cause tissue damage are discussed. The illnesses of the patients presented in this study are compared with the acute radiation syndrome as it was observed in Japanese victims of the atomic explosions in 1945. An effort has been made to review the pertinent literature.

RADIOTHERAPY

2274

POSSIBILITIES OF FISSION-PRODUCT CESIUM-137 FOR TELECURIE THERAPY. W. S. Eastwood. Nucleonics 10, No. 2, 62(1952) Feb.

Cs^{137} is suggested for telecurie therapy as an alternative to Ir^{192}. Its half life is 33 yr, its γ's are monokinetic, and concentration in a small volume seems feasible. For a 50-c source, about 2½ in. of Pb is needed as shielding.

2275

APPARATUS FOR ADMINISTRATION OF COLLOIDAL GOLD-198. D. L. Tabern, G. I. Gleason, and R. G. Leitner. Nucleonics 10, No. 2, 63-4, 66(1952) Feb.

An apparatus designed particularly for intravenous, intrapleural, or intraperitoneal administration of collodial Au^{198} is described. It permits accurate measurement and sterile transfer of calculated doses from the shipping container. It utilizes readily available and freely disposable tubing. Personnel exposure is kept at a minimum and precautions are taken against spills and contamination.

2276

I^{131} DISTRIBUTION IN NORMAL AND HEMITHYROIDECTOMIZED RATS TREATED WITH DESOXYCORTICOSTERONE ACETATE. Joseph B. Boatman, Clem Russ, Joseph H. Sunder, Andrew Konnerth, and Campbell Moses. Endocrinology 50, 134-9(1952) Jan.

Intramuscular DCA or sesame oil was administered to hemithyroidectomized and sham-operated rats for thirty days, and the distribution of radioiodine in terms of the I^{131} concentration ratios determined for the thyroid, pituitary, adrenals and blood. The radioiodine trichloroacetic acid soluble and insoluble fractions of these tissues were determined. While most tissues showed increased I^{131} concentration ratios following DCA injections, the pituitary I^{131} concentration ratios were decreased with DCA, the erythrocytes of the DCA-treated animals had an increased per cent of blood radioiodine, and the radioiodine of the pituitary and adrenals of DCA treated hemithyroidectomized animals was largely found in the acid insoluble fraction. It was concluded the administration of DCA increased retention of I^{131}. The possible mechanism and significance of these findings is discussed. (auth)

2277

EFFECT OF COLLOIDAL AU^{198} ON THE GROWTH CYCLE OF LEUKEMIC CELLS AND ON THE SURVIVAL OF THEIR HOST. Horace Goldie, F. B. Watkins, Carl Powell, and Paul F. Hahn. Cancer Research 12, 92-9(1952) Feb.

Intravenous injection of colloidal Au^{198} considerably prolonged the survival of leukemic mice and reduced the number of leukemic cells in the blood and the organs (slightly in the fluid). It is concluded that the therapeutic effect of this agent is due to its direct cytotoxic action on the leukemic cell, to improvement of the regulating mechanism of the host, and to simulation of reticulo-endothelial elements. Treatment with repeated small doses of aminopterin drastically reduced the cellular content of the blood and the peritoneal fluid but allowed the replacement of destroyed leukocytes by production of the hematopoietic organs and, therefore, extended the survival of mice. Combined treatment with Au^{198} and aminopterin demonstrated a synergistic cytotoxic effect on leukemic cells. Morever, mice survived longer than mice treated with aminopterin alone. This is attributable to the compensation of the anti-anabolic effect of aminopterin by stimulation of reticulo-endothelial elements with colloidal gold. (auth)

2278

CRITICAL ANALYSIS OF THE QUANTITATIVE I^{131} THERAPY OF THYROTOXICOSIS. A. Stone Freedberg, George S. Kurland, David L. Chamovitz, and Alvin L. Ureles. J. Clin. Endocrinol. and Metab. 12, 86-111(1952) Jan.

The thyroid uptake and turnover (biologic half life) of a therapeutic dose of I^{131} can be determined from the uptake and turnover following a tracer dose. The predictability of the delivered thyroid radiation of a therapeutic dose of I^{131}, on the basis of the uptake and biologic half life following a tracer dose, is sufficiently accurate to allow for calculated I^{131} dosage. (auth)

TOXICOLOGY STUDIES

2279
Atomic Energy Project, Univ. of Rochester
QUARTERLY TECHNICAL REPORT; OCTOBER 1, 1951 THRU DECEMBER 31, 1951. Feb. 11, 1952. 59p. (UR-200)

Data on various phases of a study of fluoride toxicity are presented. Included are data on the fluoride concentration of placental tissue where water supplies of the mothers contained varying concentrations of fluorine, the effect of renal dysfunction on the urinary excretion of fluoride, skeletal storage of fluoride in the human, miscellaneous tissue fluoride concentration studies, fluoride excretion in industrial fluoride workers, and blood fluoride levels in dogs following inhalation of hydrogen fluoride. The effect of heavy metals on tissues and cells studied with short-term feeding studies of Na fluorophosphate and K hexafluorophosphate in rats is reported. Neither substance was found to be markedly toxic. Isolated liver perfusion studies revealed that the experimental cirrhotic liver loses much of its ability to remove amino acids from the blood. A correspondingly great loss of the ability of the experimental cirrhotic liver to oxidatively catabolize amino acids was demonstrated using lysine-ϵ-C^{14}. The experimental cirrhotic liver retained its ability to synthesize plasma proteins, and it appeared that a high blood amino acid level preferentially favored biosynthesis of the plasma albumin fraction by the cirrhotic liver. Bone marrow studies are reported on spleen-shielded and nonshielded dogs exposed to an LD_{90-100} dose of x radiation. All dogs in the unshielded group died, while 4 of 7 dogs in the shielded group survived. Bone marrow studies offered no clue to the apparently beneficial effect of spleen shielding.

2280
Sloan-Kettering Inst. for Cancer Research
EFFECTS OF A FOLIC ACID ANTAGONIST ON NUCLEIC ACID METABOLISM, by David A. Goldthwait and Aaron Bendich. [nd] 25p. (AECU-1921)

The effect of aminopterin on the incorporation of C^{14}-formate and N^{15}-adenine into nucleic acids of the rat has been investigated. The incorporation of formate into purines was depressed by aminopterin to a greater extent than was the incorporation of adenine. This effect was noted in PNA (pentose nucleic acid) and DNA (desoxypentose nucleic acid) of intestine and PNA of liver. The effect of aminopterin on the incorporation of formate into thymine was similar to its effect on purines. The decrease of formate incorporation was more marked in the DNA than in the PNA of intestine. A "sparing" action of adenine on formate utilization for nucleic acid synthesis has been demonstrated in the rat. Investigation of C^{14}-formate incorporation into the bases of DNA revealed the highest incorporation in small intestine. Other organs, in diminishing order, were large intestine plus stomach, spleen, and finally testes, kidney and liver. The extent of incorporation of formate into DNA of these organs has been correlated with the rate of mitosis. The incorporation and the extent of its depression by aminopterin were directly related to the degree of tissue damage caused by the drug. (auth)

2281
THE EFFECT OF BAL ON THE EXCRETION AND TISSUE DISTRIBUTION OF POLONIUM IN RATS. John B. Hursh. J. Pharmacol. Exptl. Therap. 103, 450-9(1951) Dec.

Experiments showed intramuscular injections of BAL (2,3-dimercaptopropanol) doubled the ten-day excretion of Po administered to rats as a single dose, as well as bringing about a general shift from the bone marrow, spleen, and testis into muscle tissue. A mechanism of action for BAL is proposed.

2282
THE RELATIONSHIP OF THE CELL SURFACE TO METABOLISM. VII. THE KINETICS AND TEMPERATURE CHARACTERISTICS OF URANIUM-INHIBITION. Leon Hurwitz and Aser Rothstein. J. Cellular Comp. Physiol. 38, 437-50(1951) Dec.

The relationship between substrate concentration and the rate of fermentation and respiration of glucose and fructose could be fitted by the Michaelis-Menten equation in the presence or absence of an inhibiting concentration or uranium as uranyl ion. In the case of fructose fermentation the kinetics were typical of a competitive inhibition. This is shown to be a result of complex formation between uranyl ion and fructose, rather than a competition between inhibition and substrate for the enzyme. Glucose which does not complex with uranyl ion showed kinetics of inhibition of fermentation which were typically non-competitive. On the other hand, the kinetics of inhibition of respiration were more complicated, involving both non-competitive and competitive elements. The temperature characteristic for glucose fermentation was higher (22,000 cal/mol) in the presence of uranium than in its absence. Thus elevation of the temperature caused reversal of inhibition. This was not due to a decreased uranium-uptake by the cells. It is concluded that the kinetic data and temperature characteristic were incompatible with the concept that glucose enters the cell by simple diffusion. Other mechanisms of permeability are discussed including adsorption-desorption phenomena defined broadly to include the formation and dissociation of complexes. It is suggested that although such mechanisms can explain some of the kinetic data, they are not compatible with other available information. It is suggested that the best hypothesis to explain the existing information, involves the chemical alteration of sugars by enzymes located on the surface of the cell. (auth)

TRACER APPLICATIONS

2283
Oak Ridge National Lab.
IODINE DISTRIBUTION IN CHICK EMBRYOS (abstract), by Ernest L. Hunt and Prentiss Baker Huff. Oak Ridge National Lab. and Emory Univ. [nd] 1p. (AECU-1900)

Radio-iodine (I^{131}), introduced into approximately 400 hens' eggs and detected by contact autoradiograms, was utilized to determine the pattern of iodine distribution in chick embryos from 48 hours of incubation to one-day post-hatching. In general agreement with published results (Hansborough and Khan, J. Exptl. Zool. 116, (1951)), there was found to be no evidence of an iodine metabolism prior to the 10th day of incubation. At this stage the thyroid first accumulated iodine and continued to show strong activity throughout the periods studied. At 14 days the pigmented layer of the eye showed indications of accumulated iodine. Until after hatching these two structures alone demonstrated iodine. At one-day post-hatching (12 days after injection of the material) there was a general weak concentration of iodine in many structures; the liver, spleen, kidney, walls of the large blood vessels, and walls of the digestive tract, as well as in the retina. The thyroid still indicated strong activity and was histologically normal, showing no evidence of radiation damage. This pattern is compared with that noted by Dent and Hunt (Anat. Record 111, (1951)) in Anuran larvae. (Entire report. Abstract of paper for Atlanta meeting of the Association of Southeastern Biologists, April 18-19, 1952)

2284
Brookhaven National Lab.
THE FATE OF INTRAVENOUSLY ADMINISTERED POLY-

VINYLPYRROLIDONE, by Robert Steele, Donald D. Van Slyke and John Plazin. [nd] 11p. (BNL-1094)

A study is reported of tissue distribution, retention, and excretion of polyvinylpyrrolidone (PVP) in the mouse. The proposed use of PVP as a blood plasma substitute stimulated interest in the metabolism of this compound. A general formula for PVP is presented. Tissue distribution and excretion data are presented in tabular form. It was concluded that the molecules of PVP which are not excreted are stored in unaltered form by the fixed phagocytic cells of the body.

2285

Brookhaven National Lab.

THE EFFECT OF 2-4-DINITROPHENOL ON THE TURNOVER OF THE ACID-SOLUBLE PHOSPHORUS OF RAT DIAPHRAGM, by J. Sacks and F. Marott Sinex. [nd] 14p. (BNL-1095)

The effects of dinitrophenol on phosphorylation were studied in the isolated rat diaphragm. Data on the effects of DNP on the concentrations of the various phosphate compounds and specific activity data are presented in tabular form. Data on the effect of dinitrophenol on O uptake of diaphragm are presented graphically.

2286

Brookhaven National Lab.

GLUCOSE DISSIMILATION BY A FUNGUS OF THE GENUS, RHIZOPUS, by M. Gibbs and R. Gastel. [nd] 12p. (BNL-1096)

A study of glucose fermentation by *Rhizopus oryzae*, using glucose-1-C^{14}, led to the conclusion that the fermentation proceeds in accordance with the Embden-Meyerhof-Parnas glycolysis scheme.

2287

Tennessee Univ.

QUARTERLY PROGRESS AND WORK ACCOMPLISHMENT REPORT FOR QUARTER ENDING DECEMBER 31, 1951. [nd] 23p. (ORO-59)

Preliminary data are presented from studies on the long term retention of Sr^{90} in cattle and the secretion of Sr in milk. Total Ca and Ca^{45} balance studies of the absorption, metabolism, tissue distribution, exchange reactions in bone, and excretion of orally and intravenously administered Ca in cattle are reported. Preliminary data are included from an investigation of the biosynthesis of vitamin B_{12} in sheep.

2288

Radiation Lab., Univ. of Calif.

TURNOVER RATE STUDIES ON NUCLEIC ACIDS, by Anita H. Payne, Lola S. Kelly, and Hardin B. Jones. Feb. 6, 1952. 45p. (UCRL-1659)

The turnover rate of cytoplasmic pentose nucleic acid (PNA), nuclear PNA, and desoxypentose nucleic acid (DNA) in liver nucleic acids, spleen DNA, and intestine DNA was studied with the use of formate-C^{14}, glycine-2-C^{14}, adenine-4,6,-C^{14}, and $Na_2HP^{32}O_4$ under identical experimental conditions in normal mice. The turnover rate of liver nucleic acids with P^{32}, formate and glycine-2-C^{14} and in spleen DNA, intestine DNA, and tumor DNA with formate and glycine was measured in mice bearing mammary carcinoma or sarcoma transplants. Data on turnover ratios are presented in tabular form. Results indicate that there is not an independent turnover of any one fraction of the nucleic acid molecule, but that the nucleic acid molecule is synthesized *in toto*. Turnover ratios for DNA and PNA in tissues of normal and tumor-bearing mice are summarized and results of the study are compared with findings of other investigators. 57 references.

2289

Brookhaven National Lab.

THE EFFECT OF INSULIN ON THE INCORPORATION OF CARBON-14 INTO THE PROTEIN OF RAT DIAPHRAGM, by F. Marott Sinex, Jean MacMullen, and A. Baird Hastings. Brookhaven National Lab. *and* Harvard Univ. Medical School. [nd] 11p. (BNL-1113)

Insulin increased the incorporation of C^{14} from carboxyl-labeled alanine into the protein of rat diaphragm in vitro in the absence of added substrates. Pyruvate markedly decreased the incorporation of C^{14} alanine into diaphragm protein, and glucose decreased the incorporation slightly. In the presence of these added substrates, insulin had only slight effects. (auth)

2290

Brookhaven National Lab.

PHOTOSYNTHESIS IN THE SUNFLOWER LEAF STUDIED WITH C^{14}, by Martin Gibbs. [nd] 13p. (BNL-1114)

Sucrose, alanine, and malic acid formed in sunflower leaves during photosynthesis in strong and weak light were isolated and degraded in an attempt to elucidate the role of malic acid in photosynthesis and its relation to light intensity.

2291

BLOOD VOLUME OF SWINE. Sam L. Hansard, H. E. Sauberlich, and C. L. Comar. *Proc. Soc. Exptl. Biol. Med. 78*, 544-5(1951) Nov.

The P^{32} labeled red blood cell method has proven satisfactory for the determination of blood volumes in swine. Values obtained ranged in regular fashion from 7.4 to 4.6 ml/100 g body weight for 10- to 344-lb animals, respectively. (auth)

2292

DISTRIBUTION AND EXCRETION OF ELECTROLYTES AFTER ACUTE WHOLE-BODY IRRADIATION INJURY. I. STUDIES WITH RADIOPOTASSIUM. John Z. Bowers and Kenneth G. Scott. *Proc. Soc. Exptl. Biol. Med. 78*, 645-52 (1951) Nov.

Radiosensitive tissues show a variety of alterations in radiosodium concentration after total-body irradiation above an LD_{50}. In several tissues there is a decrease followed by a sharp increase; the decrease occurs at the same time as a decrease in radiopotassium concentration. An increase in percentage water content may occur when there is a fall in radiosodium concentration. Percent loss of dry weight per day is in general most pronounced in radiosensitive tissues. Urinary excretion of radiosodium after total-body irradiation at levels approximating an LD_{50} shows a complementary homeostatic decrease in response to the excessive loss of radiosodium through the gastrointestinal tract. (auth)

2293

THE SYNTHESIS AND METABOLISM OF RADIOACTIVELY-LABELED STEROIDS. Gray H. Twombly. *Vitamins and Hormones 9*, 237-61(1951)

The synthesis of labeled cholesterol, cholestanone, coprostanone, cholestane, cholestenone, testosterone, methyl testosterone, progesterone, desoxycorticosterone acetate, and 9 estrogens is discussed. Tissue distribution and excretion studies for 5 of the steroids are reported. With the possible exception of triphenylbromoethylene none of the steroids studied was found to concentrate to any extent in the organ on which it has its physiological effect. 47 references.

CHEMISTRY

2294

Brookhaven National Lab.

THE EXCHANGE REACTION BETWEEN THE TWO OXIDATION STATES OF IRON IN ACID SOLUTION, by Joseph

Silverman and R. W. Dodson. Columbia Univ. and Brookhaven National Lab. [nd] 30p. (BNL-1097)

The rate of exchange between ferrous and ferric iron in perchloric and hydrochloric acid solutions has been measured at ionic strength 0.55 f, at temperatures from 0 to 20°C. The reaction is first order in the over-all concentration of each oxidation state. The rate increases with decreasing acid concentration and with increasing chloride concentration. The results suggest four reaction paths involving ferrous ion, namely with: (1) unhydrolyzed ferric ion, Fe^{+3}, (2) $FeOH^{++}$, (3) $FeCl^{++}$, and (4) $FeCl_2^+$. The specific rate constants at 0°C are 0.87, 2.0×10^3, 9.7 and about 15 f^{-1} sec^{-1}, respectively, for these reaction paths. The corresponding experimental activation energies are 9.9, 7.4, 8.8, and about 10 kcal/mole, respectively. The rate increases with ionic strength. No evidence was found for a specific perchlorate ion effect. (auth)

2295
New Hampshire Univ.
THE REACTION OF FLUORINE WITH ZINC, NICKEL AND SOME OF THEIR BINARY COMPOUNDS; SOME PROPERTIES OF ZINC AND NICKEL FLUORIDES, by Helmut M. Haendler, William L. Patterson, Jr. and Walter J. Bernard. Feb. 1, 1952. 15p. (NYO-3160)

The reaction of fluorine with zinc, zinc oxide, zinc bromide, zinc sulfide, nickel, nickel(II) oxide, nickel(III) oxide and nickel sulfide has been investigated. Zinc fluoride and nickel(II) fluoride are the only non-volatile products observed. The crystal structures of the two fluorides have been checked and more precise lattice constants determined. Both are tetragonal; for zinc fluoride $a_0 = 4.7021 \pm 0.0003$ A, $c_0 = 3.1328 \pm 0.0005$ A; for nickel fluoride $a_0 = 4.6505 \pm 0.0003$ A, $c_0 = 3.0837 \pm 0.0005$ A. The densities have been redetermined; for zinc fluoride d = 5.00 ± 0.05 g/cc; for nickel fluoride d = 4.72 ± 0.05 g/cc. The melting point of zinc fluoride is 875 ± 3°C. (auth)

2296
New Hampshire Univ.
THE THERMAL DECOMPOSITION OF AMMONIUM HEPTAFLUOROZIRCONATE (IV), by Helmut M. Haendler, Charles M. Wheeler, Jr., and Dean W. Robinson. Jan. 28, 1952. 8p. (NYO-3158)

A study has been made of the thermal decomposition of ammonium heptafluorozirconate, $(NH_4)_3ZrF_7$, using the technique of differential thermal analysis. The decomposition proceeds in three distinct stages, $(NH_4)_3ZrF_7 \rightarrow (NH_4)_2ZrF_6 \rightarrow NH_4ZrF_5 \rightarrow ZrF_4$. The temperature of decomposition is a function of the pressure. (auth)

2297
Brookhaven National Lab.
VAPOR-LIQUID EQUILIBRIA OF METHANOL-CARBON TETRACHLORIDE IN SOLUTIONS OF LOW METHANOL CONCENTRATION, by Kenneth M. Sancier. [nd] 20p. (BNL-1108)

The vapor-liquid equilibria of solutions 0.0002 to 1.0 mole fraction methanol in carbon tetracholride at 10, 20, 30, 40 and 50°C have been examined. The equilibrium vapor and liquid compositions and the total pressure above these solutions at the five temperatures are reported. The "pure" vapor pressures of methanol, $P_{\underline{a}}$ (a function calculated from the quotient $P_{\underline{a}}/N_{\underline{a}}$ of partial pressure of methanol $P_{\underline{a}}$ and mole fractions of methanol in the liquid $N_{\underline{a}}$), and the calculated values of the heat of vaporization of methanol both conclusively indicate that in solutions more dilute than 0.001 mole fraction methanol there still exists strong intermolecular attraction. This interaction is attributed to the existence of methanol dimers. A value of 7.6 to 11.2 kcal/mole is estimated for the dissociation of the dimer; this is the energy of the hydrogen bond if there is one hydrogen bond per dimer, and if there are two hydrogen bonds per dimer the energy of the bond is one-half this value. (auth)

2298
California Univ., Berkeley
THE SOLUBILITY OF WATER IN LIQUID PHOSPHORUS, by G. L. Rotariu, E. W. Haycock, and J. H. Hildebrand. [nd] 5p. (AECU-1923)

Determinations of the solubility of water in liquid phosphorus gave 3.6 ± 0.3 mg/g at 45° and 3.9 ± 0.5 at 25°. 6.7×10^{-3} ml H_2O/1 ml P_4 at 25° was selected for evaluation. Published figures for H_2O in CS_2 and CCl_4 give 1.95×10^{-4} and 1.59×10^{-4} ml H_2O/ml of solvent, respectively. The solubility parameter of water calculated from this data give 26.2 for H_2O in P_4, 26.1 in CS_2 and 24.7 in CCl_4. A previously published analysis of data for H_2O in paraffins gave values close to 24.5. (auth)

2299
Louisiana State Univ.
THEORY OF KINETIC POLAROGRAPHIC CURRENTS AND CONVERSION OF RATE CONSTANTS, by Paul Delahay. Jan. 1952. 13p. (NP-3625; Technical Report No. 5; U20833)

Equations are derived for polarographic currents controlled by the rate of a tautomeric transformation (ring ⇌ aldehydo equilibrium for aldoses) and by the rate of recombination of H^+ with the anion of a weak acid (pyruvic acid). These equations enable one to calculate conventional rate constants for the chemical process controlling the current. The equations are applicable only when the limiting current is entirely controlled by the rate of the kinetic process. (NRS abst.)

2300
American Electro Metal Corp.
AN INVESTIGATION OF THE ALLOYS OF ALUMINUM AND MOLYBDENUM, by R. L. Wachtell. 49p. (AF-TR-6601 (pt.1))

It has proved possible to produce intermetallic compounds of molybdenum and aluminum and, from these intermetallics, to fabricate bodies of sufficient size and strength to permit preliminary testing. The intermetallic compounds of the Mo/Al system appear to be limited to two in number, of the composition $MoAl_2$ and $MoAl_5$. The oxidation resistance properties of these materials and combinations of them have been found to be most unusual, with a deterioration in performance noted in certain cases in the lower (900-950°C) temperature ranges. Alloys have been developed, however, which show oxidation resistance characteristics (as measured by weight change) comparable with those of $MoSi_2$. Strengths of the materials in their present state of development are of the order of 35 to 40,000 psi in transverse rupture. A negative thermal coefficient of electrical conductivity has been noted in certain of the alloys tested. At least some of the alloys show unusually good resistance to red and white fuming nitric acids when tested at room temperature. Preliminary heat shock tests have given good results, showing no deterioration in strength after 10 cycles. (auth)

2301
Ames Lab.
ON THE DISTRIBUTION OF CHARGE IN THE CO BOND OF CO_2, by Harrison Shull. Feb. 15, 1952. 18p. (ISC-211)

The average position of the negative charge in one-half of the CO_2 molecule is computed from each of the eleven occupied molecular orbitals resulting from Mulligan's self-consistent-field treatment. The calculated distribution differs appreciably from that reported by Mulligan (*J. Chem. Phys.* *3*, 573(1935)) using these same molecular orbitals, and also from previous independent estimates. The reasons for these differences are discussed. (auth)

2302

Iowa State Univ.

THE STABILITY OF THE TETRAMETHYLAMMONIUM POLYIODIDES IN ETHYLENE CHLORIDE, by Robert E. Buckles, James P. Yuk and Alexander I. Popov. [nd] (AECU-1916)

The three known tetramethylammonium polyiodides, $(CH_3)_4NI_3$, $(CH_3)_4NI_5$, and $(CH_3)_4NI_9$, have been studied spectrophotometrically in ethylene chloride. The pentaiodide and the enneaiodide were shown to have absorption spectra consistent with the view that they are virtually completely dissociated into the triiodide and iodine. The method of continuous variation applied to mixtures of iodine and tetramethylammonium monoiodide gave evidence that the only stable polyiodide in ethylene chloride is the triiodide. The dissociation of the triiodide into the monoiodide and iodine was calculated to have a pK value of 7.0 ± 0.2 at 25°. (auth)

2303

STOICHIOMETRY OF THE PHOTOLYSIS OF WATER BY ILLUMINATED CHLOROPLAST FRAGMENTS. John D. Spikes. Arch. Biochem. Biophys. 35, 101-9(1952) Jan.

Simultaneous determinations of the rate of oxygen evolution, the rate of reduction of added oxidant, and the rate of hydrogen-ion production during the photolysis of water by illuminated chloroplast fragments were made continuously on the same system during the course of illumination. The stoichiometry indicated in the following equation was found to hold within the experimental error throughout the course of the reaction: $4K_3Fe(CN)_6 + 4K^+ + 2H_2O \rightarrow 4K_4Fe(CN)_6 + 4H^+ + O_2$. None of the component reactions of the photolysis of water could be dissociated under the conditions employed in order to permit separate study. (auth)

2304

THE SOLUBILITY OF CADMIUM IN MIXTURES OF CADMIUM CHLORIDE WITH OTHER CHLORIDES. Daniel Cubicciotti. J. Am. Chem. Soc. 74, 1198-1200(1952) Mar. 5.

The solubility of cadmium in mixtures of cadmium chloride with the chlorides of potassium, calcium, cerium, manganese, magnesium, and zinc was determined at 740°C. The addition of any of these salts to cadmium chloride reduced the solubility of the metal. The effectiveness of the salts in reducing the solubility is compared with the anion to cation ratio of the salt and the electropositiveness of the metal of the cation. An hypothesis as to the structure of the solutions is considered. (auth)

2305

THE REDUCTION OF NICKEL OXIDE BY HYDROGEN. Giuseppe Parravano. J. Am. Chem. Soc. 74, 1194-8(1952) Mar. 5.

The reduction of nickel oxide by hydrogen has been studied in the range 150 to 350°C and initial pressures of hydrogen from 200 to 500 mm. The addition of foreign ions to nickel oxide affects both the rate and activation energy for reduction. These effects have been related to the change in the electronic properties of the oxide. (auth)

2306

ON THE EFFECT OF CATION RADIUS ON THE FORMATION ENERGY OF ADDITION COMPOUNDS. IV. THE ALKALI FLUORIDE – MOLYBDENUM(VI) OXIDE SYSTEMS. O. Schmitz-Dumont and Irmgard Heckmann. Z. anorg. u. allgem. Chem. 267, 277-92(1952) Jan. (In German)

The systems LiF-, NaF-, KF-, RbF-, and CsF-MoO_3 were investigated by thermal analysis and x-ray diffraction. Cubic compounds of the composition $M_3MoO_3F_3$ that melted congruently appeared in the KF, RbF, and CsF systems. In the NaF system this compound melted incongruently, and in the LiF system did not exist. It is concluded that the Li compound has a negative, the Na compound a weakly positive, and the other alkali metal compounds strongly positive energies of formation. The energy of formation of the $[MoO_3F_3]^{-3}$ complex is calculated to be +115 kcal/mole. The compound M_3MoO_4F were formed by melting $M_3MoO_3F_3$ in dry air. LiF reacted with MoO_3 on heating to form MoO_2F_2. The reaction of aqueous HF on MoO_3, as well as solution of $K_3MoO_3F_3$, produced polyfluoromolybdates of variable composition; for example, $8MoO_3.5KF.6H_2O$.

2307

CONTRIBUTIONS TO THE CHEMISTRY OF THE ELEMENTS NIOBIUM AND TANTALUM. VIII. ON THE SYSTEM $Nb_2O_5 - Ta_2O_5 - NbO_2 - TaO_2 - H_2O - H_2$. Harald Schäfer and Günther Breil. Z. anorg. u. allgem. Chem. 267, 265-76(1952) Jan. (In German)

The reduction of Nb_2O_5, Ta_2O_5, and their mixtures in a H_2 + steam current was investigated at 900°C. Nb_2O_5 and Ta_2O_5 were completely miscible. Solid solutions with > 76% Nb_2O_5 had a different x-ray-diffraction pattern from Nb-poor mixtures. The O content in the pentoxide phase was variable within certain limits. NbO_2 was able to take up TaO_2; a mixed dioxide phase therefore exists. The equilibrium solid resulting from the action of moist H_2 on the pentoxide mixture was either heterogeneous or homogeneous, depending on the Nb:Ta and H_2:H_2O ratios; it consisted of pentoxide and dioxide phases or only one of these. The composition of the heterogeneous composition was related to the H_2O vapor pressure.

ANALYTICAL PROCEDURES

2308

Ames Lab.

QUANTITATIVE SPECTROGRAPHIC ANALYSIS OF THE RARE EARTH ELEMENTS, by Velmer A. Fassel, Harold D. Cook, Laird C. Krotz, and Paul W. Kehres. Mar. 3, 1952. 20p. (ISC-210)

Emission spectrographic methods are described for the quantitative determination of those rare earths usually associated with purified La, Ce, Pr, and Nd. The procedures are based on d-c carbon-arc excitation of rare earth oxide-graphite mixtures. The unique similarity in the vaporization rate among the rare earths discussed, and the use of internal-standard line-pair components possessing similar excitation characteristics provide a high degree of internal-standard compensation for the excitation variables inherent in d-c arc sources.

2309

Atomic Energy Research Establishment, Harwell, Berks (England)

THE ANALYSIS OF COBALT-URANIUM ALLOYS, by G. W. C. Milner and R. Macara. Oct. 22, 1951. 9p. (AERE C/R-796)

A satisfactory scheme is described for the complete analysis of cobalt uranium alloys containing from small amounts to approximately 40% of cobalt. The cobalt is determined volumetrically using the titration based on the oxidation of cobaltous ions in ammoniacal solution with standard potassium ferricyanide. Uranium is separated from cobalt by a double precipitation as ammonium diuranate and finally ignited to U_3O_8. Silicon is determined by the usual dehydrating procedure of fuming with sulfuric acid and determining any loss in weight on treating the residue with hydrofluoric acid. Other elements occur in this type of alloy in trace amounts only and the spectrographic technique is satisfactory for the determination of their concentrations. (auth)

2310

California Univ., Berkeley

SOME APPLICATIONS OF SOLUBILITY THEORY TO ANALYTICAL PROBLEMS, by Joel H. Hildebrand. [nd] 17p. (AECU-1924)

The theory of solutions of nonelectrolytes is reviewed with special reference to applications in analytical chemistry. Included are a classification of intermolecular forces as to both type and strength, a classification of solutions, and a discussion of partition in the light of these, with applications to analytical separations and chromatography.

2311

Arkansas Univ.

ELECTROSTATICS OF REACTIONS FROM COULOMBIC ENERGIES AND THE ARRHENIUS EQUATION, by Edward S. Amis. Feb. 8, 1952. 12p. (NP-3633; Technical Report No. 1; U20865)

Equations for determining the effects of the dielectric constant of the reaction media upon the specific rate constants of reactions involving different combinations of ionic and polar reactants are derived from coulombic energy considerations and the Arrhenius equation. This method applies only to the dielectric constant effect but can be used with various electrically charged and electrically unsymmetrical combinations of reactants. The equations are applied to available data on the inversion of sucrose by H_3O^+ at 41°C and the 25°C reactions of tert-BuCl with H_2O and diacetone alcohol with OH^-. (NRS abst.)

2312

THE DETERMINATION OF TUNGSTEN AND MOLYBDENUM IN TITANIUM. H. G. Short. Analyst 76, 710-14(1951) Dec.

A colorimetric method has been developed for the determination of small amounts (0.002 to 0.10%) of molybdenum and tungsten in titanium metal. Colored complexes are formed with toluene dithiol, and these are extracted from aqeuous solution with amyl acetate for measurement of the color intensity. Molybdenum reacts at low acidity and is extracted first; tungsten is then extracted from strongly acid solution. It has been shown that the thiocyanate method, based on that used for tungsten in steel, gives high results when used for titanium. (auth)

2313

DETERMINATION OF MICROMICROGRAM QUANTITIES OF RADIUM. John H. Harley and Stephen Foti. Nucleonics 10, No. 2, 45-7(1952) Feb.

The method of determining the Ra elimination rate from exposed workers described is based on α counting of urine samples. Any low-background α counter can be used. The lower limit of measurement is about 0.1 $\mu\mu$g of Ra; above 1 $\mu\mu$g, the accuracy is 20%.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2314

Atomic Energy Research Establishment, Harwell, Berks (England)

A SIMPLE DEVICE FOR OBTAINING X-RAY DIFFRACTION PATTERNS FROM COARSE-GRAINED MATERIALS, by R. W. Cahn and T. W. Baker. [nd] 5p. (AERE M/M-35)

A simple device is described for use in conjunction with a "Unicam" x-ray goniometer, which will give good Debye-Scherrer lines with coarse-grained or single-crystalline material. (auth)

2315

ON THE STRUCTURE OF URANINITE FROM ACARÍ, RIO GRANDE OF THE NORTH, BRAZIL. Elysiário Tavora. Anais acad. brasil. cienc. 23, 155-8(1951) June 30. (In Portuguese)

Report is made of crystallographic studies of fragments of a specimen of uraninite from Acarí. Cu K radiation was used. A Debye-Scherrer film is shown.

2316

AN OBSERVATION ON THE EXISTENCE OF CUBIC MOLYBDENUM CARBIDE. H. Nowotny and R. Kieffer. Z. anorg. u. allgem. Chem. 267, 261-4(1952) Jan. (In German)

Carbon-rich carbides of Mo were investigated by x-ray diffraction. It was found that the observed lines do not belong to the cubic face-centered Mo_2C structure, but to a phase corresponding more to MoC with a small carbon defect. The cubic face-centered lattice with a = 4.27 kX can not be the true structure, but is probably a substructure.

DEUTERIUM AND DEUTERIUM COMPOUNDS

2317

THE PREPARATION AND CHARACTERIZATION OF SOME DEUTEROBORON COMPOUNDS. Anton B. Burg. J. Am. Chem. Soc. 74, 1340-1(1952) Mar. 5.

Deuterodiborane was prepared by D_2-diborane exchange. The 98% B_2D_2 had a vapor tension of 238.3 mm (corr.) at −111.9°C. Occasional overheating of the exchanging mixtures led to minor yields of deuterated pentaborane; a sample between $B_5H_2D_7$ and B_5HD_8 had a vapor tension of 67.5 mm at 0°C. It was noticed also that the methyl ether complex formed from 85% deuterated diborane had a dissociation pressure of 30 mm at −78.5°C; this would indicate 32 mm for pure $(CH_3)_2OBD_3$ in equilibrium with B_2D_6 and $(CH_3)_2O$ at −78.5°C. A 75% deuterated sample of diborane was separated into 70 and 80% fractions by overnight treatment with an equal gas-volume of methyl ether at −78.5°C. $(CH_3)_2ND$ was prepared by the room temperature reaction of $[(CH_3)_2N]_2BH$ with 99.8% D_2O. The final product had a vapor tension of 546 mm (corr.) at 0°C. $(CH_3)_2NBD_2$ was prepared by heating B_2D_6 and $(CH_3)_2ND$ in a sealed bulb for 6 hr at 137°C. The vapor tension at 0°C may have been 2% higher than that of $(CH_3)_2NBH_2$. More B_2D_6 was added to the $(CH_3)_2NBD_2$ at 106°C (12 hr), quantitatively forming $(CH_3)_2NB_2D_5$. This showed a vapor tension of 105.2 mm at 0°C. BD_3CO was prepared in 85% yield by treating B_2D_6 (1 atm) in a bomb tube with CO (10 atm) during 1 week at room temperature. Vapor pressures of BD_3CO are tabulated from −111.85 to −78.5°C.

2318

PRESSURE-INDUCED ABSORPTION. I. THE CALCULATION OF PRESSURE-INDUCED ABSORPTION IN PURE HYDROGEN AND DEUTERIUM. J. Van Kranendonk and R. Byron Bird. Physica 17, 953-67(1951) Nov.-Dec. (In English)

The pressure-induced infrared absorption in the usually forbidden 0−1 vibrational band of hydrogen and deuterium has been calculated by considering in detail the molecular distortions induced during binary collisions, which result in an absorption proportional to the square of the density (at constant volume). The total induced dipole moment of a an interacting pair of molecules consists of two contributions: (1) an "atomic distortion effect" resulting from the overlap forces, which is predominantly responsible for the Q-branch, and (2) the "quadrupole distortion effect" resulting from the polarizing effect of the permanent quadrupole moments of the molecules, which effect is primarily responsible for the O- and S-branches. The calculated total absorption coefficients at 300°K for the 0−1 band of H_2 are about half as big as the experimental values given by Crawford et al. (Phys. Rev. 75, 1607(1949); 76, 580 (1949); 80, 469(1950)); this agreement is satisfactory inasmuch as the calculated results depend strongly on several quantities which are not well-known. The relative intensities of the O-, Q-, and S-branches, however, are in close agreement with the experimental values. (auth)

2319

PRESSURE-INDUCED ABSORPTION. II. THE CALCULATION OF PRESSURE-INDUCED ABSORPTION IN HYDROGEN-HELIUM MIXTURES. J. Van Kranendonk and R. Byron Bird. Physica 17, 968-75(1951) Nov.-Dec. (In English)

The theory of pressure-induced absorption developed in I is extended to include an explanation of the phenomenon in mixtues. The enhancement of H_2 and D_2 infrared absorption due to the addition of He is calculated for 300°K, and the results are compared with the available experimental measurements. The theory explains the fact that the ratio of intensities S : Q is less for H_2-He than for pure H_2. (auth)

FLUORINE AND FLUORINE COMPOUNDS

2320

Argonne National Lab.

ISOTOPE EXCHANGE REACTIONS OF FLUORINE WITH HALOGEN FLUORIDES, by Richard B. Bernstein and Joseph J. Katz. Argonne National Lab. and Illinois Inst. of Tech. Feb. 6, 1952. 14p. (AECU-1904; UAC-505)

The gas phase exchange of radioactive F^{18} between elemental fluorine and the halogen fluorides, ClF_3, BrF_5 and IF_7 has been investigated in copper, aluminum and nickel reaction vessels. The rate of isotope exchange at temperatures below 100° was essentially zero in all cases. Complete exchange occurred within a few minutes in the region of 300°, and conveniently measurable rates were observed at intermediate temperatures. To evaluate the heterogeneous contribution to the gas phase exchanges, the behavior of fluorine and the halogen fluorides with AlF_3, CuF_2, NiF_2, and CaF_2 was examined. Fluorine exchange with the metal fluorides was slow; the halogen fluorides exchanged rapidly, but the extent of exchange decreased with increasing temperature. These exchanges are significant only in the temperature range where exchange between fluorine and the halogen fluorides is small, and consequently the latter exchanges are considered primarily homogeneous. A mechanism for the exchange based on the well-known reversible dissociation of ClF_3 and IF_7 is reasonable in the light of the data. Since quantitative data were lacking for IF_7, preliminary measurements of the temperature dependence of the dissociation constant were made, which indicate that the $\Delta H°$ and $\Delta S°$ for dissociation are comparable with the values known for ClF_3. However, in the case of BrF_5, no dissociation was observed up to 400°C, and the possibility of an associative mechanism for this exchange is suggested. (auth)

2321

New Hampshire Univ.

THE SYSTEM AMMONIUM FLUORIDE–SODIUM FLUORIDE–WATER AT 25°, by Helmut M. Haendler and Avis Clow. Jan. 28, 1952. 6p. (NYO-3159)

The system ammonium fluoride–sodium fluoride–water has been studied at 25°. The system is simple; the solid phases are ammonium fluoride and sodium fluoride. No hydrate of sodium fluoride was found. (auth)

2322

Minnesota Mining and Manufacturing Co.

ANNUAL PROGRESS REPORT NO. 2; MAY, 1950 TO MAY, 1951, by W. H. Pearlson. [nd] 76p. (NP-3630; Annual Progress Report No. 2; ATI-119351)

This report describes work on the preparation and evaluation of fluorinated elastomers suitable for use in the presence of aromatic fuels and at low temperatures. Although no satisfactory elastomer was found, the exploratory polymerization studies led to generalizations in the field of fluorinated polymers. Fluorine was found to promote resistance to swelling or solution by non-fluorinated solvents. Systems investigated include several fluorinated polyamides and polyesters, perfluoroolefin-vinyl ether systems, fluorinated acrylonitriles, fluorinated butadienes, vinyl-perfluoracyl esters, 1,1-dihydroperfluoroalkyl fumarates, sorbates and crotonates, and 1,1-dihydroperfluoroalkyl acrylates, the latter seeming to be the most promising system investigated.

2323

PERFLUOROALKYL HALIDES PREPARED FROM SILVER PERFLUORO–FATTY ACID SALTS. II. PERFLUOROALKYL BROMIDES AND CHLORIDES. Murray Hauptschein, Edward A. Nodiff, and Aristid V. Grosse. J. Am. Chem. Soc. 74, 1347-50(1952) Mar. 5.

The reaction of an excess of Br_2 and Cl_2 with Ag trifluoroacetate, Ag pentafluoropropionate, and Ag n-heptafluorobutyrate resulted in the formation of high yields of bromotrifluoromethane, chlorotrifluoromethane, bromopentafluoroethane, and chloropentafluoroethane, as well as the new compounds 1-bromoheptafluoropropane and 1-chloroheptafluoropropane. The physical properties of these compounds are tabulated, and the infrared spectra are traced. The infrared spectra of iodotrifluoromethane also is shown.

GRAPHITE

2324

[Argonne National Lab.]

SEARCH FOR LOW TEMPERATURE SUPERCONDUCTIVITY IN GRAPHITE COMPOUNDS, by G. Hennig and L. Meyer. Feb. 1952. 3p. (AECU-1906; UAC-507)

Samples of graphite compounds were prepared from polycrystalline artificial graphite and tested for superconductivity at low temperatures. Those samples which remained rigid during the preparation were mounted between electrical leads to measure the resistance at low temperatures. Other samples which became fragile during the reaction were sealed with He into glass tubes and tested for appearance of the Meissner effect at low temperatures. The samples included bisulfate residue and lamellar compounds, K residue compounds, Br residue and lamellar compounds, Ca residue compounds, ammonium residue compounds, untreated graphite, and graphitized lampblack containing 0.15% B. No evidence for superconductivity was found in the region investigated (down to 1.3°K).

2325

THE THERMAL DEPENDENCE OF THE ELASTIC MODULI OF POLYCRYSTALLINE GRAPHITE. F. E. Faris, L. Green, Jr., and C. A. Smith. J. Applied Phys. 23, 89-95 (1952) Jan.

Young's modulus and the shear modulus of grade SA-25 molded graphite and grade AUF extruded graphite were measured as functions of temperature in the range from 25–2000°C. In the case of the extruded material, variations of the two moduli with position and direction relative to the axis of extrusion were also investigated. The moduli were found to increase with temperature, a behavior in contrast with that exhibited by most materials. Maxima in the low frequency shear modulus values and increases in the internal friction of both graphites observed in the range 1550–1750°C may possibly be interpreted in terms of grain boundary relaxation. The bulk modulus and Poisson's ratio at room temperature were calculated from the data for the nominally isotropic SA-25 graphite to be 6×10^{10} dynes/cm^2 and 0.27, respectively. (auth)

LABORATORIES AND EQUIPMENT

2326

AUTOMATIC SAMPLE SEPARATOR FOR RADIOACTIVE LIQUIDS. A. E. Bennett. Nucleonics 10, No. 2, 14-18 (1952) Feb. (cf. NSA 5-5587)

For use with the ion-exchange process of separating fission products, completely automatic equipment has been designed that distributes the various separated elements into different containers and gives a detailed record of activity. Photographs and diagrams of the apparatus are included.

RADIATION CHEMISTRY

2327

Oak Ridge National Lab.
RECOIL REACTIONS WITH HIGH-INTENSITY SLOW-NEUTRON SOURCES; II. THE RETENTION OF RADIOBROMINE BY CRYSTALLINE $KBrO_3$, by J. W. Cobble and G. E. Boyd. Issued Mar. 17, 1952. 15p. (ORNL-1117)

A time variation of the retention of radiobromine as bromate was observed in the bombardment of pure crystalline $KBrO_3$ in the Oak Ridge graphite pile. The retention increased from an apparent zero time value of 9 ± 1% to a constant value of 32 ± 1% after about 16-hr irradiation. A value of 13 ± 1%, which was independent of time, was obtained when the crystals were kept at −195°C during the neutron bombardment. Heating the irradiated $KBrO_3$ above 80°C effected a return of Br^{82} to bromate at a rate dependent upon the temperature. A radiation-induced return of radiobromine was also discovered when these crystals were exposed to gamma radiations from an intense Co^{60} source. No simple rate law was found capable of describing the thermal back-reaction which showed a positive temperature coefficient. The radiation-induced back-reaction, however, obeyed a first-order velocity equation, and the rate was directly proportional to the source strength. A slight but distinct temperature dependence was also found. An attempt was made to estimate the finite zero time retention as the result of contributions from a "cage" effect and from a non-zero "retention probability" estimated stochastically. It is proposed that the attainment of a constant retention in long-time neutron irradiations is the consequence of the establishment of a steady state between the rate of production of separable Br^{82} and the rate of its recombination back to bromate by pile gamma rays and fast neutrons. (auth)

2328

Radiation Lab., Univ. of Calif.
RADIATION CHEMISTRY OF AQUEOUS SOLUTIONS CONTAINING BOTH FERROUS ION AND CARBON DIOXIDE, by Warren M. Garrison and G. K. Rollefson. Jan. 28, 1952. 15p. (UCRL-1657)

The radiation chemistry of acid ferrous sulfate, solutions containing dissolved carbon dioxide has been studied using high-energy helium ions from the cyclotron as the radiation source. The principal products formed are ferric ion and hydrogen in a proportion very close to two moles of ferric ion to one mole of hydrogen. A small fraction of the hydrogen is used to form reduction products of carbon dioxide. The most important of these is formic acid, but there are also much smaller amounts of formaldehyde and oxalate produced. The formate concentration approaches a definite limit asymptotically and is proportional to the concentration of dissolved carbon dioxide. A proposed mechanism gives the rate law

$$\frac{d[(HCOOH)/(H_2CO_3)]}{d(Fe^{+3})} = a - b(HCOOH)/(H_2CO_3)$$

which fits the observed data over the entire range of observation.

RADIATION EFFECTS

2329

Brookhaven National Lab.
THE MOLECULAR YIELD IN THE DECOMPOSITION OF WATER BY HARD X-RAYS, by Everett R. Johnson and Augustine O. Allen. [nd] 24p. (BNL-1101)

Dilute aqueous solutions of a number of oxidizing and reducing agents at various concentrations give, on irradiation with hard x rays, identical initial yields of hydrogen gas. This yield of molecular hydrogen is therefore characteristic of the action of x rays on water, and occurs simultaneously with the formation of free radicals which react with solutes. The molecular yield is decreased about 18% by addition of 4% of sulfuric acid to the water. (auth)

2330

RADIATION CHEMISTRY AND STERILIZATION OF BIOLOGICAL MATERIALS BY IONIZING RADIATIONS. John P. O'Meara. Nucleonics 10, No. 2, 19-23(1952) Feb.

The undesirable chemical effects produced in foodstuffs, pharmaceuticals, and biological materials by sterilization with ionizing radiations are discussed and compared with effects of heat sterilization. It appears that radiation sterilization is more efficient when the material is irradiated in the frozen state. Approximate calculations are included which illustrate differences in distribution of thermal and ionizing energy in the sample.

2331

ACTION OF IONIZING RADIATIONS ON COLLOIDAL SOLUTIONS. Moïse Haïssinsky and W. Gluzbarg. Compt. rend. 233, 1192-4(1951) Nov. 12. (In French)

Previous generalizations that ionizing radiations coagulate or diminish the stability of positively charged colloids but have a weak stabilizing or no effect on negatively charged colloids are supported by the results of the present study on Cu, Ag, and Au colloids exposed to Ra γ rays, Ra-Be neutrons, and cyclotron D + Be neutrons. These effects are attributed to formation of free OH radical and its subsequent reactions.

2332

ON THE DECOMPOSITION BY X RAYS OF DILUTE SOLUTIONS OF HYDROGEN PEROXIDE. Marc Lefort. Compt. rend. 233, 1194-5(1951) Nov. 12. (In French)

Aqueous solutions varying in H_2O_2 concentration between 10^{-6}M and 10^{-3}M were irradiated with x rays, and the quantities of evolved gases and residual H_2O_2 were determined. Formation of H_2 was proportional to the total radiation dose, except at high H_2 concentrations, and did not depend on the concentration of H_2O_2 or on any conditions affecting the decomposition of H_2O_2. Evolution of O_2, however, was dependent on these conditions. Several mechanisms involving OH free radicals are discussed as possible explanations of this behavior.

RARE EARTHS AND RARE-EARTH COMPOUNDS

2333

ON IMPERFECTIONS PRODUCED IN ALKALINE EARTH HALIDES BY INCLUSION OF RARE EARTHS. Peter Brauer. Z. Naturforsch. 6a, 562-3(1951) Oct. (In German)

In rare-earth-activated alkaline-earth phosphors, the inclusion of the trivalent ion causes imperfections in the lattice of divalent ions. The problem of calculating the energy of conversion of the trivalent to the divalent state under these conditions is attacked by lattice theory. A hypothetical "work of ionization" is calculated and plotted for the oxides, sulfides, tellurides, and selenides of Mg, Ca, Sr, and Ba. From the knowledge that Eu is trivalent in the oxides and divalent in the other compounds, the ionization potential can be estimated as ~32 ev. Sm, trivalent in all the compounds, must have an ionization potential <28 ev.

2334

THE REACTION OF CERIUM WITH OXYGEN. Daniel Cubicciotti. J. Am. Chem. Soc. 74, 1200-1(1952) Mar. 5.

The oxidation of cerium has been found to obey the parabolic law from 30 to 125°C. Above 125° the reaction started parabolically but subsequently became linear. The parabolic portion became shorter as the temperature was increased. Cerium was the most rapidly oxidizing metal yet studied. The energy of activation of the parabolic reaction was the smallest yet observed. (auth)

2335

ON THE PREPARATION AND CRYSTAL STRUCTURE OF DISILICIDES OF CERTAIN RARE EARTH METALS. Georg Brauer and Heinz Haag. Z. anorg. u. allgem. Chem. 267, 198-212(1952) Jan. (In German)

A preparation method is given for silicides of metals difficult to obtain in pure elemental form. Heating of the metal oxides with elemental Si in a vacuum with sublimation of SiO leads to pure silicides in excess molten Si, from which they can be isolated by chilling in dilute alkali solution. $LaSi_2$, $CeSi_2$, $PrSi_2$, $NdSi_2$, $SmSi_2$, YSi_2, and silicides of Yb and Sc were prepared in this manner. Pyknometric densities and x-ray-diffraction data are tabulated. Crystal structures are discussed and compared with those of the actinide silicides. $Ce_2Si_2Al_3$ also was prepared during this experiment; lattice constants are given.

2336

PRODUCTION OF PURE RARE EARTH METALS. Frank H. Spedding, Harley A. Wilhelm, Wayne H. Keller, Donald H. Ahmann, Adrian H. Daane, Clifford C. Hach, and Robert P. Ericson. Ind. Eng. Chem. 44, 553-6(1952) March

The method for producing pure rare earths at Iowa State College, Ames, Iowa, is described. A brief review of the development which led to this Ames process is also given. The process produces ingot which contains 1 to 5% Ca and 0.1 to 1% Mg as its major impurities.

2337

OBSERVATIONS ON THE FLUORINATION OF PRASEODYMIUM AND NEODYMIUM COMPOUNDS. Alexander I. Popov and George Glockler. J. Am. Chem. Soc. 74, 1357-8(1952) Mar. 5.

Attempts to prepare higher oxidation states of Pr and Nd by reaction of the oxides, hydrated oxalates, and trifluorides with technical-grade ClF_3 and BrF_3 were unsuccessful, yielding only the trifluorides. It is noted that Pt is attacked by BrF_3, in contradiction to the observations of Sharp and Emeleus (J. Chem. Soc., 2135(1948)). Crystalline, easily precipitated rare-earth trifluorides were obtained by dissolving the nitrate in 95% alcohol and slowly adding a 40% HF solution until precipitation was complete. The resulting product was an anhydrous salt rather than the usual monohydrate.

2338

ON EUROPIUM IN ALKALINE EARTH OXIDES AND SULFIDES. Peter Brauer. Z. Naturforsch. 6a, 561-2 (1951) Oct. (In German)

The optical emission spectra of MgO, CaO, SrO, BaO, MgS, CaS, SrS, and BaS, each activated with $\sim10^{-4}$ parts of Eu, were determined; the Eu lines are shown. The oxide phosphors show only the lines of Eu^{+3}, whereas the sulfide phosphors show only the lines of Eu^{++}. In the Eu^{+3} spectra one line is much more intense than the others.

2339

ON THE CRYSTAL STRUCTURE AND REFLECTION SPECTRA OF THE OXYFLUORIDES OF PRASEODYMIUM, NEODYMIUM, AND SAMARIUM. L. Mazza and A. Iandelli. Atti accad. ligure sci. 7, 44-52(1950). (In Italian)

The relations between crystal structure and reflection spectra have been studied for various rare-earth oxyfluorides and fluorides. X-ray-diffraction powder data, which are tabulated, on PrOF, NaOF, and SmOF show that these have the fluorite structure with cell constants 5.644, 5.595, and 5.519, respectively. Solid solutions were found to form between the oxyfluorides and fluorides with an increase in cell constant depending on the amount of F-atom inclusion. The optical reflection spectra of PrO_3, PrOF, PrF_3, Sm_2O_3, SmOF, Nd_2O_3, NdOF, NdF_3, and NdOF + NdF_3 are tabulated; these spectra are characteristic of the composition and structure.

SEPARATION PROCEDURES

2340

Rensselaer Polytechnic Inst.

LIQUID-LIQUID EXTRACTION, by J. O. Hougen. Jan. 15, 1952. 7p. (SO-3500)

The content of this report is limited to a description of the objectives of and experimental methods used in an investigation of liquid-liquid extraction. Any data obtained are only of an exploratory nature. The work is divided into three parts: (1) securing fundamental information on the transfer of a solute from one liquid phase to another, (2) investigating the influence which the size, type and geometry of typical extraction column packings have upon the discontinuous phase droplet size and size distribution, and (3) obtaining performance data on an extraction column of semicommercial dimensions. The report is largely confined to a description of apparatus and methods. (auth)

2341

Louisiana State Univ.

THEORY OF CATALYTIC POLAROGRAPHIC CURRENTS, by Paul Delahay and George L. Stiehl. Dec. 1951. 26p. (NP-3626; Technical Report No. 4; U20832)

A theory is developed for polarographic currents controlled by diffusion and by the rate of a catalytic process which regenerates the substance reacting at the dropping Hg electrode; it accounts quantitatively for the properties of catalytic waves. The dependence of catalytic currents on concentration, rate constant, and the head of Hg and the influence of temperature are discussed. A graphical method is reported for determining rate constants from experimental currents. This theory is applied to catalytic currents obtained in the reduction of Fe^{+3} in the presence of H_2O_2 (0.0145 to 0.362 mole/l.) by the methods described by Kolthoff and Parry (J. Am. Chem. Soc. 73, 3728(1951)). Calculated and experimental data are in good agreement. (cf. TIP U20199) (NRS abst.)

2342

Wisconsin Univ.

ADDITION COMPOUNDS OF ZIRCONIUM AND HAFNIUM TETRACHLORIDES WITH PHOSPHORUS OXYHALOGEN COMPOUNDS, by Edwin M. Larsen, John Howatson, Adrian M. Gammill and Layton Wittenberg. Jan. 31, 1951. 13p. (NP-3643; Technical Report III)

Zirconium and hafnium tetrachlorides react with $POCl_3$, and $POFCl_2$ to give addition products of the composition $2POX_3{\cdot}MCl_4$ which decompose under reduced pressure at 50 to 60° to give $MCl_4{\cdot}POX_3$. With POF_2Cl and POF_3, the metal tetrahalides give onyl $MCl_4{\cdot}POX_3$ at room temperature. All the 1:1 products when heated decompose with the evolution of the phosphorus oxyhalide, with the temperature at which the decomposition is first observed decreasing with increasing fluorine content of the POX_3. No significant difference is observed in the behavior of the zirconium and hafnium compounds. If the contact time of the MCl_4 with excess $POFCl_2$ or POF_2Cl is long enough, complete halogen exchange within the phosphoryl molecule occurred and $MCl_4{\cdot}2POCl_3$ was crystallized from solution. (auth)

2343

THE SEPARATION OF TITANIUM, ZIRCONIUM, AND THORIUM BY ION EXCHANGE. William E. Brown and William Rieman III. J. Am. Chem. Soc. 74, 1278-82(1952) Mar. 5.

A method has been developed for the quantitative separation of titanium, zirconium, and thorium by ion-exchange technique. The nature of the complexes between metal and citrate ions has been investigated, and some probable complexes are given. Radiochemical work with Ti^{51} showed that the radioactive isotope was, to a certain extent, separated from the normal isotopes. It is believed that partial separation of the natural isotopes of titanium was achieved and that this separation accounts for the unusual shape of the elution curve of this element. (auth)

2344
THE BEHAVIOR OF TITANIUM, NIOBIUM, AND TANTALUM COMPOUNDS IN HYDROCHLORIC ACID AS A FOUNDATION FOR A NEW PREPARATIVE SEPARATION METHOD. Josef Wernet. Z. anorg. u. allgem. Chem. 267, 213-37(1952) Jan. (In German)

With the intention of separating Ti as $(NH_4)_2TiCl_6$ from Nb and Ta, the author has studied the behavior of various compounds of these elements, particularly the hydrated oxides and chlorides, in highly concentrated HCl and the reaction of these solutions with NH_4Cl. The Ti precipitates as $(NH_4)_2TiCl_6$ in every case. The Ti content of a mixture containing ~3% TiO_2 in Nb_2O_5 was reduced to <0.07% TiO_2 in one step by this method. In a mixture of 50 wt. % TiO_2 and Ta_2O_5 the separation resulted in ~1% TiO_2 remaining in the Ta_2O_5. In a Ti-Nb-Ta mixture with a Ti : Nb ratio ≥ 2, the Nb precipitated with the $(NH_4)_2TiCl_6$. This coprecipitation suggests a way of separating both these elements from Ta.

SPECTROSCOPY

2345
Duke Univ.
QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH; AUGUST 1, 1951 - NOVEMBER 1, 1951, by Walter Gordy. [nd] 68p. (NP-3614; U17991)

Current projects dealing with O and O_3 are reviewed. The measurement of 2 fine structure lines in the 5-mm wave region with N in the same concentration as in air (78%) indicated a 30% broadening of the O line breadths over that for pure O from 1- to 8-mm Hg. A recording of 1 of these lines is given for N. A system providing strong markers of adjustable position and separation was devised for measuring line widths. The frequency of the X-band oscillator source is stabilized by the Pound method for an external cavity. The oscillator output is multiplied with a crystal-harmonic generator and side-band markers are produced by properly mixing the stabilized frequency with the output of a calibrated oscillator of about 5 Mc. The frequencies and relative strengths of several O_3 absorption lines from 5 to 14 mm are listed. (cf. TIP U17992-U17993) (NRS abst.)

2346
Argonne National Lab.
USE OF DISCHARGE TUBES IN SPECTROCHEMICAL ANALYSIS, by Mark Fred. Feb. 13, 1952. 7p. (AECU-1914; UAC-516)

The design of the hollow-cathode discharge tube used by Schüler and Gollnow (Z. Physik 93, 612(1935)) is described briefly, and modifications developed at Argonne are described and diagramed. The performance and precision of such tubes are discussed, and mention is made of recent and current experiments utilizing them. The strong neutral spectrum obtained with the source described makes it valuable for a study of rare-earth and heavy-element spectra. Al cathodes have been used in most of the work cited, but precise wavelength measurements are being made with an Fe cathode which provides a good source of the Fe spectrum for wavelength comparisons.

2347
Brookhaven National Lab.
THE INFRARED ABSORPTION SPECTRA OF SOLUTIONS OF METHANOL IN CARBON TETRACHLORIDE IN THE SECOND HARMONIC REGION, by Kenneth M. Sancier. [nd] 17p. (BNL-1112)

The infrared absorption spectra in the second harmonic region of the OH stretching frequency has been studied with solutions which are 0.006 to 1.0 mole fraction methanol in carbon tetrachloride at 25 and 45°C. The monomer band is found at 1.39 μ, and the broad association band has at least three components at about 1.44, 1.51 and 1.56 μ. The concentration and temperature dependence of the area of the association band and of the extinction coefficient of the monomer band is studied. The degree of association of the methanol is calculated from the monomer and from the polymer bands and compared to show the change of oscillator strength of the OH vibrator in the various polymers. The CH stretching band at about 1.7 μ is resolved upon dilution into three bands at 1.62, 1.68 and 1.72 μ. (auth)

SYNTHESES

2348
Pittsburgh Univ.
PROGRESS LETTER FROM OCTOBER 1, 1951 TO DECEMBER 31, 1951, by Robert Levine, John H. Wotiz, Lloyd B. Barkley, Newton N. Goldberg, Thomas F. McGrath, Carl Osuch, and Bruno M. Perfetti. Issued Jan. 14, 1952. 5p. (NYO-942)

A brief report is presented on the progress made on one-step synthesis of a number of α-substituted fluorinated β-diketones.

2349
THE LABELING OF BACTERIAL CELLS WITH S^{35} FOR THE PRODUCTION OF HIGH SPECIFIC ACTIVITY COMPOUNDS. Dean B. Cowie, Ellis T. Bolton, and Margot K. Sands. Arch. Biochem. Biophys. 35, 140-5(1952) Jan.

Results demonstrate that 23.4 mc of bound sulfur taken up by 0.15 ml of cells provide a means of specifically labeling both methionine and cystine (2×10^9 counts/sec/mg of sulfur) without interference from excessive radiation exposure of the cells. It is also apparent that extremely small numbers of E. coli cells can be labeled and detected. (auth)

TRACER APPLICATIONS

2350
TRACER-DIFFUSION IN LIQUIDS. I. DIFFUSION OF TRACER AMOUNT OF SODIUM ION IN AQUEOUS POTASSIUM CHLORIDE SOLUTIONS. Jui Hsin Wang. J. Am. Chem. Soc. 74, 1182-6(1952) Mar. 5.

A method of measuring the diffusion of tracer amount of a radioactive ion in salt solution is developed. The diffusion coefficients of tracer amount of radioactive sodium ion in aqueous potassium chloride solutions of concentration between 0.00494 and 4.14 formular weight per liter are determined. It is shown that the "tracer-diffusion" coefficients of sodium ion in aqueous potassium chloride solutions as calculated by the Onsager theory agree with the measured values at various concentrations from infinite dilution up to about 0.05 formular weight per liter within experimental uncertainties. Above 0.1 formular weight per liter the "tracer-diffusion" coefficient of sodium ion first increases, reaching a maximum value near 1.3 formular weight per liter, and then starts again to decrease with increasing salt concentration. qualitative explanation of the concentration dependence of the "tracer-diffusion" coefficient of sodium ion in concentrated aqueous potassium chloride solutions is attempted. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

2351
OXIDATION POTENTIAL OF THE Pu(III) – Pu(IV) COUPLE IN PERCHLORIC AND HYDROCHLORIC ACID. Robert E. Connick and W. H. McVey. J. Am. Chem. Soc. 74, 1341 (1952) Mar. 5.

Correction of an error in a previous paper (J. Am. Chem. Soc. 73, 1798(1951); NSA 5-2765) results in the following corrected formal potential scheme in 1M HCl at 25°C:

$$\underbrace{\mathrm{Pu(III)}\;\overset{-0.969}{\text{———————}}\;\mathrm{Pu(IV)}\;\overset{-1.052}{\text{———————}}\;\mathrm{Pu(VI)}}_{-1.024}$$

The Pu(IV) complexed by chloride ion at 25°C in 1M HCl becomes 40%. The anomaly of a more negative potential for the Pu(III) – Pu(VI) couple in HCl than in $HClO_4$ is now intensified. The discrepancy may arise primarily from an error in the Pu(III) – Pu(IV) – Pu(VI) equilibrium constant caused by reduction of Pu(IV) to Pu(III) by the products of the α particles of the Pu.

TRITIUM AND TRITIUM COMPOUNDS

2352
Knolls Atomic Power Lab.
MASS SPECTROMETRIC DETERMINATION OF THE HYDROGEN-TRITIUM EQUILIBRIUM, by H. C. Mattraw, C. F. Pachucki and L. M. Dorfman. [nd] 4p. (AECU-1901)

Equilibrium concentrations of H_2, HT, and T_2 were measured with an analytical mass spectrometer on a number of H_2-T_2 samples over a wide range of pressures and compositions. The measurements gave an average value of $K = (HT)^2/(H_2)(T_2) = 2.87 \pm 0.06$ as compared with a theoretical value of 2.57.

2353
THE COMBUSTION OF TRITIUM-LABELLED ORGANIC COMPOUNDS. P. R. Payne, I. G. Campbell, and D. F. White. Biochem. J. 50, 500-2(1952) Feb.

The tritium in water can be estimated with high efficiency by reducing the water to hydrogen, and measuring the currents obtained through hydrogen-filled ion chambers or, more conveniently, by preparing tritio-methane from the water and determining the tritium content in a proportional counter. Thus the estimation of the tritium content of organic substances will usually necessitate their combustion to water; a technique suitable for the routine combustion of organic compounds for this purpose has been devised. (auth)

URANIUM AND URANIUM COMPOUNDS

2354
THE FLUORITE PHASE IN THE U_3O_8–Er_2O_3 SYSTEM. F. Hund and U. Peetz. Z. anorg. u. allgem. Chem. 267, 189-97(1952) Jan. (In German)

A fluorite phase was observed in the U_3O_8-Er_2O_3 system between 27.0 and 66.7 mole % Er_2O_3. The lattice constant of the mixed crystals varied linearly from 5.349 ± 0.001 to 5.303 ± 0.001 A at the Er-rich end. Pyknometric densities were compared with values calculated for both the anion and cation defective lattice types. The structure of the mixed crystals is that of an ideal cation lattice with excess anions in interlattice positions or with vacancies in the anion partial lattice. Some considerations on the structure of U_3O_8 and Er_2O_3 are given by extrapolated lattice constants.

WASTE DISPOSAL

2355
Knolls Atomic Power Lab.
DISPOSAL OF RADIOACTIVE WASTES. (An Introduction for Designers of Non-AEC Laboratories), by E. C. Pitzer. Nov. 1, 1951. 23p. (KAPL-703)

A report is presented on the method of disposing of radioactive waste and the topics considered are the amount of radioactivity in the normal environment, the amount of activity that might safely be discharged in industrial wastes, waste disposal procedures and waste disposal problems that would be encountered in typical hypothetical research projects.

ENGINEERING

2356
Engineering Research Inst., Mich. Univ.
PROGRESS REPORT NO. 2; UTILIZATION OF THE GROSS FISSION PRODUCTS, by L. E. Brownell, L. C. Anderson, H. H. Gomberg, J. J. Martin, W. W. Meinke, R. B. Morrison, L. Thomassen, E. T. Vincent, R. A. Wolfe, and G. J. Van Wylen. Jan. 31, 1952. 123p. (AECU-1889; Progress Report No. 2)

Some experimental results have been obtained on all subprojects. These results are described in the report and are abstracted as follows: On subproject M943-A (Fundamental Study of Effects of Radiation on Combustion Engine Performance), combustion has been conducted with gaseous mixtures under nonexplosive conditions and reaction rates have been measured for various gaseous fuels without the influence of radioactive material. On subproject M943-B (Performance of Combustion Engines under the Influence of Radiation), a small-sized experimental burner has been operated with and without ionizing beta radiation. Pd^{109} has been used as a source of radiation. Tests have also been made on an experimental diesel engine (subproject M943-B), which will be operated with radioactive palladium in the combustion zone. A pressure reaction chamber or bomb has been fabricated for subproject M943-C (Effects of Radiation on Chemical Reactions), and some preliminary tests have been made in the 1000-curie Co^{60} source and with Pd^{109}. On subproject M943-D (Preservation of Foods and Drugs by Irradiation), a variety of foods, drugs and microorganisms have been irradiated in the Co^{60} source. The sterilization of heat-labile drugs by gamma irradiation appears to be one of the most promising commercial uses of the radioactive waste fission products. On subproject M943-E (Exploratory Research), alloys of strontium and aluminum have been prepared, which may have possibilities in the industrial use of the fission products. Cooperative research has been undertaken with other groups interested in the use of the fission products. These other groups include (1) Project 20 of the Michigan Memorial-Phoenix Project; (2) the Atomic Energy Commission, Biological Effects of Irradiation Laboratory; and (3) Research and Development Division of Parke, Davis and Company. Results of this cooperative research are reported under subproject M943-D. (auth)

2357
Brookhaven National Lab.
COUNTING ROOM ELECTRICAL DESIGN DATA, by John M. Ruddy. Feb. 7, 1952. 9p. (BNL-1117)

The design of the electrical components necessary in a counting room are discussed. The principal items of interest to the electrical design engineer are the nuclear and electromagnetic radiation shielding, lighting and power, voltage regulation, grounding, and the air conditioning of the counting room. Each one of the above named items are discussed independently. Diagrams are given of a typical electrical installation for a counting room.

2358
MACHINING GRAPHITE IN AN ATOMIC ENERGY PLANT. J. M. Case and R. E. Dew. Machinery (N.Y.) 58, 147-153 (1952) Feb.

The methods employed at Carbide and Carbon Chemicals Co., Oak Ridge, Tenn. for machining graphite are described. Woodworking tools are used in roughing operations, but carbide-tipped tools are necessary for precision finishing. The modification necessary to use standard machines for machining graphite is also described.

HEAT TRANSFER AND FLUID FLOW

2359

Technical Information Service, AEC

HEAT TRANSFER; A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Alan T. Morphew, comp. Mar. 18, 1952. (TID-3022)

This bibliography contains 320 annotated references to unclassified research on heat transfer. Reports held by the Technical Information Service as of March 7, 1952, are covered.

2360

Brookhaven National Lab.

FLUID DYNAMICS OF POROUS SYSTEMS, by L. P. Hatch and Sheldon Isakoff. [nd] 13p. (BNL-1106)

A generalized equation for flow of fluids through porous systems is derived on the basis of the following concepts: (a) that for any given or "fixed" system the equation would be the same as the equation for flow through tubes, except for the values of the numerical coefficient; (b) that the spacing of particles (or other impervious units) in a porous system, relative to particle diameter, is an independent variable of fundamental significance; (c) that the particle-spacing parameter can be measured by the ratio of the permeable to impermeable volume fractions, and provides a direct and common basis for viewing the problem of fluid flow through porous systems over a wide range; and (d) that by considering the velocity of the fluid within the system itself in relation to the velocity of the particles one general equation is found to satisfy the requirements for flow in (1) consolidated granular beds, (2) fluidized beds, (3) hindered settling of dense suspensions, and possibly (4) hindered settling of dilute suspensions. (auth)

2361

Columbia Univ.

MASS TRANSFER IN LIQUID METAL AND FUSED SALT SYSTEMS; SECOND QUARTERLY PROGRESS REPORT, by Charles F. Bonilla. Dec. 1, 1951. 11p. (NYO-3087)

The line of attack being followed in current investigations of the following problems is outlined: mass transfer between a bed of particles and a liquid metal flowing through it, mass transfer between two liquid metals in a spray column, velocity of droplets of liquid metal or salt in a spray column, and diffusion coefficients in liquid metals. No experimental data are given.

2362

Columbia Univ.

MASS TRANSFER IN LIQUID METAL AND FUSED SALT SYSTEMS; FIRST QUARTERLY PROGRESS REPORT, by Charles F. Bonilla. Sept. 1, 1951. 8p. (NYO-3086)

In this first quarterly progress report a brief summary is given of mass-transfer studies carried out on an unsponsored basis prior to the date of the AEC contract. Natural-convection mass transfer was investigated by depressing horizontal cylinders of Pb, Zn, Cd, and Sn beneath the surface of a Hg bath; the change in buoyant force due to dissolving of the cylinder was measured as a function of time. The four mass-transfer cases agreed moderately well among themselves, and a reasonable correlation was found with the heat-transfer case. The poorest agreement was with the Pb points, which averaged about 65% of the heat-transfer correlation. Forced-convection mass transfer from the inner surface of a cylindrical tube to the fluid flowing within the tube was also investigated with water and with Hg as the flowing fluid. The limited data obtained agree rather well with curves previously reported for nonmetals.

2363

Columbia Univ.

NATURAL CONVECTION HEATING AND COOLING BY HORIZONTAL CYLINDERS; QUARTERLY REPORT, by C. F. Bonilla, J. P. Collins, and G. Stolz, Jr. Jan. 1, 1952. 6p. (NYO-566)

A study of the effect of direction of heat flow on natural-convection heat transfer has been undertaken using high-viscosity sucrose solution. An apparatus is being constructed that is directed toward obtaining higher heat-transfer rates to liquid metals than heretofore. It employs hot Hg pumped through a horizontal tube to yield a high internal coefficient of heat transfer and a high temperature difference.

2364

Columbia Univ.

NATURAL CONVECTION HEATING AND COOLING BY HORIZONTAL CYLINDERS; QUARTERLY REPORT, by C. F. Bonilla and D. F. Palazzo. Oct. 1, 1951. 9p. (NYO-565)

A study is being carried out of both heating and cooling by natural convection from the same horizontal cylinder. The tube measured 0.5 in. in diameter and was surrounded by a bath of water or Essolube 30 motor oil, to provide different temperature coefficients of viscosity. The usual correlation for natural convection heating by a horizontal cylinder was found somewhat conservative for both heating and cooling, and therefore satisfactory for most design purposes. Heating and cooling curves for water agreed well. Since liquid metals have even less variation of viscosity with temperature, correlations developed for the heating of liquid metals by natural convection should apply equally well for cooling. The oil gave a curve for heating about 25% above that for cooling. The results for both liquids can be correlated approximately by introducing the ratio of bulk viscosity to wall viscosity to a fractional power. The final equation obtained, for the range of (Grashoff number × Prandtl number) of 10^4 to 10^6, is: $Nu_{\underline{f}} = 1.85 (Gr \cdot Pr \cdot (\mu_B/\mu_W)^{0.35})^{0.17}$.

2365

HEAT TRANSFER IN ISOTROPIC TURBULENCE. Stanley Corrsin. J. Applied Phys. 23, 113-18(1952) Jan.

The postulated problem of heat transfer in a stationary isotropic turbulence under constant small temperature gradient is examined from both Lagrangian and Eulerian points of view. By combination of Taylor's "diffusion by continuous movements" and a new temperature fluctuation equation somewhat like the well-known turbulent energy equation, it is possible to obtain (1) an expression for the turbulent heat transfer coefficient which depends only on velocity field, and (2) an approximate expression for the corresponding correlation coefficient which depends only on velocity field and fluid physical properties. A preliminary result is given for "turbulent Prandtl Number" in a homogeneous shear flow in terms of the shear and heat transfer correlation coefficients. (auth)

RADIOGRAPHY

2366

National Research Council of Canada

IRIDIUM 192 FOR GAMMA RAY RADIOGRAPHY, by Adair Morrison. Feb. 20, 1951. 11p. (NRC-2407)

An evaluation of Ir^{192} as a γ-ray source for industrial radiography is presented. A half life of 74 ± 1 days was established from measurements of a sample over a period of 150 days. Data are presented on the decay scheme, energy levels, exposure data for Kodak "Noscreen" film, shielding required for shipping, and cost of production of Ir^{192} samples.

VACUUM SYSTEMS

2367

Atomic Energy Research Establishment, Harwell, Berks (England)

"O" RING SEALED VACUUM VALVES, by P. A. Shatford. Aug. 28, 1951. 4p. (AERE G/M-96)

A simple isolation valve and a two-way valve are described, which depend upon sliding "O" ring seals for their operation. The valves have been made in a number of sizes to fit standard pipelines ranging from ¼-in. to 1-in. bore. (auth)

WASTE DISPOSAL

2368

Brookhaven National Lab.

PREPARATION OF SPHERICAL CLAY PARTICLES CONTAINING RADIOACTIVE IONS, by George P. Simon and William S. Ginell. [nd] 8p. (BNL-1105)

In recent studies on the use of clay minerals of the montmorillonite group for the ultimate disposal of radioactive fission wastes, it was found possible to introduce radioactive cations into the mineral by ion exchange and then, by thermally altering the mineral structure, to render the exchanged ions non-replaceable. Replacement tests were carried out by treating samples of radioactive clay (which had been heated to sintering temperatures in a muffle furnace) with a synthetic sea water for lengths of time ranging from six months to one year, and determining the release of activity with time. It was found that clay which had been ground after heating to 900°C released much more activity than similarly treated unground clay. A method is described for heating the montmorillonite particles individually by passing them through the flame of an oxygen gas torch, thus minimizing the loss of activity caused by sintering and grinding. Electron-microscope and x-ray diffraction studies on the particles are briefly reported. Individual particles of the ground clay are angular; those prepared by the torch, spherical.

2369

ATOMIC ENERGY INDUSTRY. J. H. Hayner. Ind. Eng. Chem. 44, 472-5(1952) Mar.

The planned programs of research and development bearing on handling of waste products by the nuclear energy industry are described. There are several reasons for such a program: The products have a high hazard potential; the industry has grown at a phenomenal rate from laboratory scale processes to plants of major industrial size; security restrictions have prevented supervision by public agencies; and substantial expansion of the industry into new and broader fields is contemplated with increased problems of disposal and environmental hazards. This paper classifies the sources of radioactive wastes, describes methods of waste treatment, and defines limitations and tolerances for radioactive wastes. Public health and environmental aspects of atomic energy are discussed. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

2370

RADIOASSAY OF POTASSIUM IN SOLID SAMPLES. O. J. Russell. Brit. J. Applied Phys. 3, 47-50(1952) Feb.

A discussion is given of a method of determination of K in solid samples. Powdered mineral samples are poured into the sample-holding space of G-M counters designed for liquid samples. Any pure stable K salt is suitable for a standard of calibration. Density corrections for β absorption are given in the form of a normalization curve, so the use of an effectively infinite sample thickness is unnecessary. Interference was experienced from U present in the phosphatic constituents of fertilizer samples tested. It was found possible to correct for this, and obtain satisfactory agreement with chemical determinations.

CORROSION

2371

CORROSION GUIDE. Erich Rabald. New York, Elsevier Publishing Co., Inc., 1951. 629p.

A review of this book appeared in Nature 169, 257-8 (1952) Feb. 16 and is reproduced here in part.

This book has forty-five pages on general principles, followed by more than five hundred pages of tables summarizing experience with various materials in numerous environments. In the tables four categories of corrosion resistance of materials to environments are distinguished, based where possible on practical experience, and otherwise on laboratory determinations of weight loss per unit area per unit time. Few indications of liability to pitting, intergranular corrosion, or stress corrosion are given.

GEOLOGY AND MINERALOGY

2372

WELL LOGGING IN THE SPRABERRY. W. J. Lytle and R. R. Rieke. Oil Gas J. 50, No. 32, 92-4, 96, 105(1951) Dec. 13.

The use of the combination γ ray-induction log is described. The interpretation of γ-induction logs and comparison of them with conventional electric logs are discussed. Experience with the method has indicated that is is very useful in obtaining drill-hole characteristics as follows: formation correlations and identification of lithological types, qualitative estimates of porosity, and semiquantitative estimates of water saturation.

METALS AND METALLURGY

2373

Institute for the Study of Rate Processes, Univ. of Utah

THE PARABOLIC-LINEAR OXIDATION RATE TRANSITION THEORY, by William McKewan and W. Martin Fassell, Jr. Feb. 1, 1952. 17p. (AECU-1918; Technical Report No. VII)

A new theoretical concept is proposed to account for the type of oxidation exhibited by metals upon exposure to an oxidizing atmosphere at elevated temperatures. The hypothesis is based on the relative rates of oxidation and recrystallization of the tarnish coating. If the recrystallization rate of the oxide coating formed on the surface is greater than the oxidation rate of the metal, the coating will be protective and hence will follow the parabolic equation. If the reverse situation is true, the coating will be non-protective and the rate curve will be linear. The theory appears to explain qualitatively the experimental results reported in the literature or found by the authors for pure metals. In addition, it provides a new approach to the problem of heat-resistant alloys.

2374

Battelle Memorial Inst.

NOTES FROM THE CONFERENCE ON URANIUM METALLOGRAPHY AT BATTELLE MEMORIAL INSTITUTE ON JULY 10, 1949, by R. F. Dickerson. Feb. 7, 1952. 19p. (TID-5076)

A complete summary is given of the proceedings of the conference held to compare and discuss techniques of U sample preparation and the meaning of the structures obtained. A representative set of photomicrographs of the cooperative specimens is included. A comparison of the photomicrographs indicates that there are no differences in interpretations of microstructures due to techniques of specimen preparation. The brightfield work shows that progress has been made with various etchants, but that improvements and modifications should be made in the direction of inclusion preservation in etched structures. It is felt that the etching problem will be simplified with the advent of high-purity metal.

2375
North American Aviation, Inc.
SELF-DIFFUSION IN SILVER, by R. D. Johnson, A. B. Martin and W. V. Goeddel. Issued Mar. 3, 1952. 28p. (NAA-SR-170)

A radioactive tracer method has been employed to measure the rate of self-diffusion in silver, using Ag^{110} for the tagged atoms. The apparatus and procedure are described in detail. The experimental results obtained yielded the diffusion constants $Q = 40{,}800 \pm 700$ cal/mole and $D_0 = 0.11 \pm 0.05$ cm²/sec for the volume diffusion process. Diffusion rates were measured in polycrystalline material in the temperature range from 903°C down to 497°C, and in single crystals at 697°C. The linearity of the log D vs. 1/T plot indicates the consistency of the results, and the absence of any effects of grain-boundary diffusion on the measured diffusion rates down to 640°C. (auth)

2376
Pennsylvania State Coll.
THE CORROSION OF ZIRCONIUM, by L. E. Colteryahn, W. Joseph, W. E. Ray, and H. J. Read. Dec. 31, 1951. 17p. (NYO-837)

Thin films of zirconium satisfactory for corrosion studies have been obtained by cathodic sputtering onto electropolished copper foil. The conditions which had been previously reported as yielding continuous films remain unchanged. A preliminary x-ray study indicated that some difference in crystal structure results when zirconium oxide is prepared from the hydroxide which has been precipitated from an aqueous solution with sodium hydroxide or ammonium hydroxide and subsequently ignited. The rate of oxidation of zirconium at elevated temperatures has been found to increase very rapidly in the presence of water vapor. Up to the present time, very little success has been attained in the preparation of magnesium single crystals which would be satisfactory as basis metals for the growth of single-crystal films of zirconium by epitaxy. (auth) (cf. NYO-836; NSA 6-234)

2377
Illinois Inst. of Tech.
THE REACTIONS OF METALS WITH GASES AND SALTS AT HIGH TEMPERATURES; THE OXIDATION OF SILICON AT HIGH TEMPERATURES, by Merwyn B. Brodsky and Daniel Cubicciotti. Aug. 1950. 13p. (NP-3158; Technical Report No. 8; U13884)

The oxidation rate of Si was determined from 950 to 1160°C as a function of O-pressure decrease with time following the heating of samples in a closed system under a vacuum of about 10^{-4} mm Hg and the introduction of O under 20 mm Hg. Oxidation curves at 950°C were parabolic for 65 min, deviating thereafter; curves at 1015 to 1120°C suggested a logarithmic law; curves above 1160°C deviated from both types. Reproducibility of oxidation-rate constants was poor, some values showing 70% departures from the average. X-ray patterns indicated vitreous-oxide formation within 100 min to α-cristobalite and quartz. The equation $w = k \log (1 + at)$ was obtained by applying Fick's law to vitreous-ozide formation, where w is the amount of oxidized material, k the rate constant, t the time, and a the temperature-independent constant rendering the term (at) dimensionless. Experimental data from 1015 to 1120°C satisfactorily fit the equation, giving the best results with $a = 1$. The linear graph of log k vs. the reciprocal of the absolute temperature gave an average activation energy of 29 kg-cal/mole. The parabolic rate constant for Si at 950°C was 6×10^{-10} g²/cm⁴ min. The values for the slow oxidizing metals Be and Ni were 1×10^{-10} and 2.5×10^{-8} g²/cm⁴ min, respectively; the log-type curves obtained for all 3 were possibly attributable to vitreous-oxide formation. (cf. TIP U11314) (NRS abst.)

2378
Battelle Memorial Inst.
THE REACTION OF ZIRCONIUM METAL SURFACES WITH OXGYEN, by M. W. Mallett, H. R. Nelson and C. A. Papp. Feb. 25, 1952. 21p. (BMI-727)

Oxygen 99.5 to 99.6% pure was dried over $Mg(ClO_4)_2$ and successively brought into contact with 29 cylindrical Zr rods ¼ in. in diameter. Each Zr specimen was maintained at a constant temperature between 600 and 1100°C for the duration of the run. It was found that oxygen reacts with zirconium at rates which appear to be close to parabolic (square-root function of time) at 600°C, decrease to a one-fourth-power function of time at 875°C, and increase to parabolic at above 1100°C. This behavior, in contrast to expected parabolic rates, is thought to be brought about by some effect of the transition from alpha to beta zirconium (865 ± 10°C). An empirical equation which expresses this behavior may be written as follows:

$$w = K_1 t^{1/2} + K_2 t^{1/4} + K_3 t^{1/2} ,$$

$$K_1 = 3.11 \times 10^{-1}\ e^{-8000/RT}\ \mathrm{ml/cm^2\text{-}sec^{1/2}},$$
$$K_2 = 2.54 \times 10^{3}\ e^{-21000/RT}\ \mathrm{ml/cm^2\text{-}sec^{1/4}},$$
$$K_3 = 2.09 \times 10^{8}\ e^{-56000/RT}\ \mathrm{ml/cm^2\text{-}sec^{1/2}},$$
w = oxygen reacted in ml/cm²,
t = time in seconds.

Energies of activation at temperatures in the neighborhood of 300°C (alpha zirconium) and 1500°C (beta zirconium) have been approximated as being 16000 cal/mole and 112000 cal/mole, respectively. Large probable errors in these values make comparisons with other reported values inconclusive. No pressure dependency of the reaction was observed.

2379
Dow Chemical Co.
BIENNIAL REPORT (December 1, 1949 - November 30, 1951); PREPARATION OF HIGH PURITY MAGNESIUM AND A STUDY OF THE EFFECT OF NON-METALLIC AND ALKALI METAL IMPURITIES ON THE CORROSION CHARACTERISTICS OF PURE MAGNESIUM. [nd] 94p. (COO-85)

Data are reported from studies of the corrosion properties of the pure Mg binary alloys with Li, Ba, Sr, K, Na, Ca, Si, C, Cl, N, O, P, and Fe. The investigations disclosed that none of these elements was detrimental except Na, Ca, Fe, and possibly C. However, there were indications that C, Cl, and Si are very detrimental if small amounts of Fe are present. P was found to be beneficial if critical amounts of Fe were present. The benefits of P were also observed in the Mg-Fe-Al alloys. A review of procedures involved and a discussion of results obtained in the purification of Mg by vacuum sublimation are included.

2380
CONTRIBUTION TO THE STUDY OF THE FORM OF TRACTION CURVES OF MONOCRYSTALLINE TEST SAMPLES. Bernard Jaoul and Charles Crussard. Compt. rend. 234, 700-2(1952) Feb. 11. (In French)

The variations in shape of the traction curves of Al single crystals of 99.8, 99.99, and 99.995% purity are related to grain size and purity. Position of the transition point is shown to depend on more variables than the minimum separation of slip bands or chemical composition.

2381

SOLVING TITANIUM MACHINING PROBLEMS. Machinery (N.Y.) 58, 160-6(1951) Dec.

This paper is an abstract of a report to the Air Materiel Command of the U. S. Air Force, published in book form by Curtiss-Wright Corporation, on the machining of Ti. Composition and physical properties of Ti alloys are tabulated and compared with steels and other engineering materials. Charts and photographs show the comparative lives of carbide tools and of high-speed steel tools in machining 150A Ti, an austenite stainless steel, and several high-temperature alloys. Preliminary data on milling and drilling of Ti alloys are given, and recommendations are made for sawing Ti. Data are presented on the development (by Lockheed Aircraft Corp.) of turning and milling techniques for the 5% Cr - 3% Al - Ti alloy.

2382

MAGNETIC STUDY OF LANTHANUM-MANGANESE ALLOYS. A. Serres. J. phys. radium 13, 46-7(1952) Jan. (In French)

Mixtures containing percentages of Mn and La corresponding to the compositions $MnLa_{20}$, $MnLa_2$, MnLa, Mn_2La, and $Mn_{20}La$ were fused in an argon atmosphere and allowed to solidify. Metallographic study showed only two phases, and thermomagnetic measurements at ordinary temperature and at 500°C showed only a weak paramagnetism corresponding additively to the amounts of Mn and La present. This evidence of insolubility of the two metals agrees with the phase studies of Rolla and Iandelli (Ber. 75, 2091(1942)).

2383

OPEN DIE FORGES TITANIUM CONES. Harold Bernstein and Ernest T. Nicotera. Am. Machinist 96, 136-7(1952) Feb. 18.

The process used in forging hollow cones from ingot Ti is described in detail. Steps in the process are illustrated.

2384

RARE METALS REQUIRE PRECISION FURNACING. Frank Gibadlo. Steel 130, No. 9, 76-8(1952) Mar. 3.

Problems involved in furnacing and casting Ti, Zr, Ta, Nb, U, Th, Ca, and Mg are discussed. Among the problems considered are the affinity of the elements for O_2 and N_2, fusion of product and container, diffusion of N_2 into the retort in furnacing hydrides, and unexpected results obtained from assuming that O content of metals and alloys is reduced or removed by elements having a higher affinity or higher heat of oxide formation than the base metal. Sketches are presented of the following: method of minimizing diffusion of gases during furnacing, protection of container by a lining of refractory oxide, an integrated high-frequency melting and casting unit, and a vertical-type retort for furnacing hydrides.

PHYSICS

2385

Knolls Atomic Power Lab.

LIQUID METALS II. THE VISCOSITY OF MERCURY VAPOR AND THE POTENTIAL FUNCTION FOR MERCURY, by Leo F. Epstein and Marion D. Powers. [nd] 18p. (AECU-1893)

It is shown that, contrary to the results of earlier studies, an excellent fit to the data on the viscosity of mercury vapor can be obtained using a Lennard-Jones 6-12 potential, in spite of the fact that x-ray scattering measurements indicate that this substance is more nearly represented by a 6-9 potential. Viscosity measurements, like second virial coefficient studies, do not appear to be sufficient by themselves to determine the repulsive power uniquely. In this study, the 6-12 parameters $\epsilon/k = 851 \pm 32$°K and $r_0 = 3.25_3 \pm 0.04_4$ A are obtained. A detailed survey of the previous studies of the potential function for mercury indicates that the values obtained from the viscosity are quite consistent with the other data. Certain difficulties in the determination of r_0 and related quantities from x-ray scattering data are pointed out. (auth)

2386

Tennessee Univ.

EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS. THIRD QUARTERLY REPORT, by W. K. Stromquist and R. M. Boarts. Jan. 31, 1952. 6p. (ORO-60)

The purpose of this investigation is to determine the effect of wetting on the heat-transfer characteristics of mercury, a typical liquid metal, by the use of additive wetting agents and variation of the heat transfer surface material. Work during the first two quarters consisted of development and the start of construction of apparatus for the study of interface effects and determination of physical properties of mercury and diluted amalgams, and operation of a pilot-model heat transfer system. During the third quarter the interface studies have progressed rapidly and construction of the heat transfer system has been started. Preliminary measurements of electrical conductivity at mercury-solid metal interfaces indicate significant differences between wetting and non-wetting conditions with respect to conductivities at the interface. Tests have shown that newly created steel surfaces immersed in mercury are wetted without additive wetting agents. A device for measuring contact angles of mercury in controlled atmospheres at elevated temperatures has been built. (auth)

2387

Ohio State Univ.

FURTHER CONSIDERATIONS REGARDING THE THEORY OF BOSE-EINSTEIN LIQUIDS, by J. G. Daunt, T. P. Tseng and C. V. Heer. [nd] 22p. (AECU-1920)

Model solutions of non-degenerate Fermi-Dirac systems in Bose-Einstein liquids, as proposed previously by Heer and Daunt, (Phys. Rev. 81, 447(1951)) are considered. A discussion is given of the physical basis for the excess partial vapor pressure of the F-D component, which is shown to be due to the degeneracy of the B-E liquid. The theory is applied to solutions of He^3 in liquid He^4, and a tentative explanation is given for the empirical hypothesis proposed by Taconis in accounting for the observed partial vapor pressures of such solutions. The results of computations of the distribution coefficient, C_v/C_L, and the total vapor pressure for strong solutions of He^3 in liquid He^4 are presented, these computations having been made using (a) the laws for perfect classical solutions, (b) the theory of Heer and Daunt and (c) the theory of de Boer and Gorter (Physica 16, 225, 667(1950)). A comparison with the experimental values of C_v/C_L and of total vapor pressures for strong solutions is given, and it is deduced that the Heer and Daunt model of a quantum solution is is good agreement with the observations at temperatures below about 1.8°K and that above this temperature the model gives qualitatively the correct trend but that owing to vapor imperfections exact numerical agreement cannot be expected. (auth)

2388

THEORY OF THE SPECIFIC HEAT OF GRAPHITE. Kozo Komatsu and Takeo Nagamiya. J. Phys. Soc. Japan, 438-44(1951) Nov.-Dec.

The graphite crystal is considered as a system of thin elastic plates spaced at a constant distance. An elastic force is assumed to act between neighboring plates in such a way that a local change of the spacing between them produces at that point a tension or a pressure normal to the plates whose magnitude is proportional to that change. The vibrations of this system are assumed to be separable into independent parts: the bending vibrations in which the displacements occur normal to the planes of the plates, and the extensional and shearing vibrations in which the displacements occur parallel to them. The frequency distributions of their normal modes are studied. The values of the elastic constants of the plates that determine the latter vibrations are derived from the force constants of the benzene molecule, while the value of the bending modulus of the plate is determined by fitting the calculated specific-heat curve with the observed one. The constants of the elastic force acting between neighboring plates are derived from the measured elastic constants of graphite (mainly the compressibility). Small contributions of the electronic specific heat and the $C_p - C_v$ correction are added to obtain the total specific heat. The result is in good agreement with experiment. (auth)

ASTROPHYSICS

2389

PRODUCTION OF COSMIC RADIATION IN STELLAR ELECTROMAGNETIC FIELDS. Arnulf Schlüter. Z. Naturforsch. 7a, 136-40(1952) Jan. (In German)

Conditions that must exist in a stellar electric field to accelerate charged particles to energies of 10^9 to 10^{10} ev are discussed. The electric field must arise by self-induction of a varying magnetic field, not by convective charge separation. A variation of Kiepenheuer's solar-magnetism model (Phys. Rev. 78, 809(1950)) is discussed by which all conditions for acceleration to 10^9 ev can be met. It is scarcely possible that particles with energies up to 10^{17} ev can be produced in any star.

COSMIC RADIATION

2390

Brookhaven National Lab.

THE PRODUCTION RATE OF COSMIC RAY NEUTRONS AND C^{14}, by Herbert J. Koute and Luke C. Yuan. [nd] 4p. (BNL-1109)

Previously published data on the low-energy capture rate of cosmic-ray neutrons are reviewed and conclusions revised. The computed low energy (n,p) capture rate by N of cosmic-ray neutrons is given as 3.50 per cm^2 sec at Princeton, which corresponds to the production rate of C^{14} by capture of these neutrons.

2391

Brookhaven National Lab.

MOMENTUM SPECTRA OF COSMIC RAY MESONS AND PROTONS AT SEA LEVEL AND 3.4 Km ALTITUDE, by W. L. Whittemore and R. P. Shutt. 25p. (BNL-1110)

A cloud-chamber experiment has been performed at sea level and 3.4 km altitude to collect data on the momentum and scattering distributions of 15,000 mesons and protons. The momentum spectra and derived conclusions are discussed here. The meson momentum distribution at sea level is in accord with the results of others. A comparison of the sea-level and altitude spectra indicates that, for momenta between 0.7 and 3 bev/c, 0 to 15% of the mesons observed at sea level are produced below 3.4 km. Assuming that production of the fast mesons observed takes place within the top 125 g/cm^2 of the atmosphere, the differential momentum distribution of mesons at production can be represented adequately as an inverse power law with an exponent equal to 2.75 ± 0.07, in good agreement with previous published results. The relative numbers of positive and negative particles at sea level agree well with those of other workers. At altitude the +/– ratio becomes quite large for the lower momenta (up to 2.5 as against 1.2 at sea level), while it approaches the sea level ratio (1.3) for high momenta. Assuming that the difference between the sea level and altitude ratios is due to protons one can compute that above 0.3 bev/c protons form 19 ± 2 % of all ionizing particles (excluding electrons) at 3.4 km. From the observed +/– ratios the proton momentum spectrum has been calculated. (auth)

2392

THE ABSORPTION CURVE OF THE COSMIC RADIATION IN THE STRATOSPHERE. Marcel Schein and Victor H. Yngve. Phys. Rev. 85, 607-8(1952) Feb. 15.

The absorption in lead of cosmic-ray particles has been measured at an altitude of 5.7 cm Hg with hitherto unattained accuracy. The absorption at this altitude is compared with the absorption at sea level. It is found that the soft component shows an increase by about a factor of 90. The hard component shows an absorption length of about 220 grams per cm^2 of Pb, very different from the sea-level absorption of μ mesons. It is concluded that most of the penetrating particles at 5.7 cm Hg are nucleons. (auth)

2393

COMPARISON OF THE RANGE AND ENERGY SPECTRUM OF PENETRATING PARTICLES IN COSMIC RADIATION. H. D. Rathgeber. Z. Naturforsch. 6a, 598-602(1951) Nov. (In German)

Absorption in water of the penetrating portion of cosmic radiation was compared with deflection of the charged particles in a magnetic field. No sudden change in energy loss was observed from 2×10^8 to 5×10^{10} ev, and it was concluded that the largest portion of cosmic radiation in this region consists of μ mesons. These results are not compatible with either the Bethe-Bloch theory of specific ionization or with Fermi's polarization considerations, but are best explained as a specific energy loss of $2.0 \pm 0.1 \times 10^6$ ev/g/cm^2, constant over the range 5×10^8 to 3×10^{10} ev. Direct measurements of the probable specific ionization with proportional counters agreed with this conclusion.

2394

SOLAR COSMIC RAYS AND THE EARTH'S MAGNETIC FIELD. Arnulf Schlüter. Z. Naturforsch. 6a, 613-18(1951) Nov. (In German)

Numerical integration of 20 trajectories of charged particles in the field of a magnetic dipole so improved Störmer's (Astrophys. Norvegica 2, 1(1936)) calculated net of trajectories assumed to start on the geomagnetic equator at the sun that, for the interesting momentum region about 10^9 ev/c, several quantitative conclusions concerning the theoretical distribution of cosmic rays on the earth could be drawn. In the middle latitudes a decided maximum at 9_h local time for positive particles and a forbidden region in the neighborhood of the pole were shown. The calculations were extended by approximations to lower energies and other solar declinations. Part of the experimental findings on solar cosmic-ray bursts contradict certain conclusions of Störmer's theory.

2395

INVESTIGATIONS OF THE LOCAL SHOWERS PRODUCED IN THIN SCREENS AND OF THE NARROW ATMOSPHERIC SHOWERS. J. Hamelin. J. phys. radium 13, 11-14(1952) Jan. (In French)

The effect of thin screens placed above a counter arrangement for detecting narrow atmospheric showers was studied; large modifications in the decoherence curves for narrow and extended showers were noted. The radiation producing the local showers responsible for these modifications was found to be neutral. It is concluded that these showers consist of electron pairs of weak energy.

2396

ON THE ORIGIN OF COSMIC RAYS. Alessandro Amerio. Rend. seminar. mat. e fis. Milano 21, 196-217(1950). (In Italian; cf. NSA 5-3164)

The author discusses his theory that the primary cosmic-ray particles are granules about 1000 A in diameter that have been emitted from hot stars and accelerated by radiation pressure. The process is shown to be feasible, but not for stars as cool as the sun.

2397

THE MAXIMA IN THE COINCIDENCE CURVES OF COSMIC RAY SHOWERS. H. Thurn and W. Bothe. Z. Naturforsch. 6a, 576-91(1951) Nov. (In German)

Cosmic-ray showers with two and three maxima in their Rossi curves were investigated with a new coincidence and anticoincidence arrangement. The showers were found to arise in a step or cascade fashion from a primary particle. These were not electron-photon cascades since they were too narrow and penetrating; their absorption path in Pb was ~ 100 g/cm^2. Their maximum frequency under Pb was more than an order of magnitude smaller than that of μ mesons. The showers with two maxima were produced by charged particles, probably μ mesons, and consisted of one charged and a number of neutral particles of unknown type. The showers with three maxima were produced by a neutral radiation, and consisted of two charged particles, probably mesons, and possibly a number of neutral particles. The position of the third maximum was related to the atmospheric pressure, reduced to sea level, in such a way that an increase of 1 cm Hg displaced the position by 1.6 cm of Pb. Other atmospheric factors had no effect. Thin Pb filters placed several meters above the apparatus had no effect on the position of the third maximum.

2398

ON INTERPRETATION OF THE DAILY VARIATION OF COSMIC RADIATION CAUSED BY WEAK MAGNETIC DISTURBANCES. A. Ehmert. Z. Naturforsch. 6a, 622-6 (1951) Nov. (In German)

The daily cycle in cosmic radiation observed following disturbances in the earth's magnetic field is shown to be limited to the zenithal radiation; thus only low-energy primary particles are involved. These can be affected by the earth's unsymmetrical field or could arise from interaction of slow or low-density solar-particle clouds with the earth's field. A preliminary hypothetical possibility of an additive acceleration or retardation of the cosmic-ray particles in the region between the earth's field and the passing plasma cloud is sketched. A correlation between the daily variation and filaments on the central meridian of the sun is indicated.

2399

SOFT RADIATION AT BALLOON ALTITUDES. C. L. Critchfield, E. P. Ney, and Sophie Oleksa. Phys. Rev. 85, 461-73(1952) Feb. 1.

Results are given on cloud-chamber observations of electron showers and "spray" events at high altitude (18 millibars). The fluxes derived for initiating radiation are consistent with a common origin for showers and "sprays," and thus support the conclusion by Rau and Wightman that "sprays" are showers produced in a single lead plate. However, less than one-fourth as many such events occur as would be expected from observations on mu-mesons if mesons are produced with a spectrum that does not vary with altitude. If all soft radiation at 18 millibars were of primary origin, it would constitute less than 0.6 percent of the total cosmic-ray flux. (auth)

2400

AIR-SHOWER CORES. W. E. Hazen. Phys. Rev. 85, 455-61 (1952) Feb. 1.

A large cloud chamber has been used to study the density and energy distributions at the cores of air showers. The observed intensities of events with a local density ≥ 500 particles/m^2 over an area less than one m^2 and of events attributed to shower axes that passed through the detector agree with ionization-chamber and G-M counter data. The observed density and energy distributions of the shower rays in events attributed to shower cores require a multiplicity of initiators with a low average energy. On the other hand, only a minor fraction of the cores shows direct evidence for multiplicity. A consistent explanation is difficult to construct. (auth)

2401

ABSORPTION OF THE NUCLEON COMPONENT OF COSMIC RADIATION IN AIR BETWEEN SEA LEVEL AND 4000 METERS. M. Teucher. Z. Naturforsch. 7a, 61-3(1952) Jan. (In German)

The number of nuclear stars at elevations of 150, 1010, 1780, 2962, and 3774 m was observed with Ilford G5 nuclear emulsions. The increase with height was fitted to the equation $N = N_0 \exp(-h/L)$, where $L = 127 \pm 3$ g/cm^2. This value is compared with results of other investigators. The number of stars observed at 3774 m with more than N_h points is plotted as a function of N_h.

2402

ON THE PHOTODISINTEGRATION OF HEAVY COSMIC-RAY PARTICLES BY SOLAR RADIATION. G. T. Zatsepin. Doklady Akad. Nauk S.S.S.R. 80, 577-8(1951). (In Russian)

Thanks to the Doppler effect, photons in solar radiation are able to cause disintegration of the heavy particles in primary cosmic radiation. The probability of this occurring at the earth's distance from the sun is calculated to be 10^{-4}. The particles from such disintegrations would create giant showers of the order of 2.5 km in extent. The possibility of observing these showers is discussed briefly.

2403

AN UNUSUAL INCREASE IN COSMIC RADIATION. A. Sittkus and Dieter Ganz. Z. Naturforsch. 6a, 563-4(1951) Oct. (In German)

At Freiburg (48°N, 8°E) two automatic cosmic-ray recorders were in operation, the one, at an elevation of 1200 m, measuring the ionization in a 60-l pressure chamber surrounded by 5 cm of Pb, the other, at 300 m, consisting of a 500-l pressure chamber surrounded by 100 g/cm^2 (10 cm of Fe + 10 cm of barite concrete). A marked increase was noted in the intensity recorded by the 1200-m station on June 8, 1951. No increase was recorded by the 300-m station, indicating an energy of about 1.3×10^9 ev. An attempt is made to relate the cosmic-ray peak to sunspot activity, but it was more likely caused by a disturbance in the earth's magnetic field.

2404

HIGH ENERGY NUCLEAR INTERACTIONS OF COSMIC RAY PARTICLES CLOSE TO THE TOP OF THE ATMOSPHERE. M. L. Vidale and M. Schein. Nuovo cimento 8, 774-97(1951) Oct. (In English)

Counter telescopes were flown with plastic balloons to a maximum altitude of 94,000 ft. Intensity vs. pressure curves were obtained at geomagnetic latitudes of $\lambda = 55$, 41, and 28° for the total cosmic radiation and for the components capable of traversing 4, 7.5, and 12 cm of Pb. The energy spectrum of primary cosmic-ray particles was derived from the extrapolation of the intensity of the total radiation to the top of the atmosphere. Results indicate that the radiation originating from primaries in the energy range 1 to 4 bev (cutoff energies at $\lambda = 55$ and 41°) is predominantly of a nucleonic nature. The soft component originating from primaries in the range 4 to 8 bev (cutoff at $\lambda = 41$ and 28°) multiplied rapidly in the atmosphere. It is concluded that the probability of producing neutral mesons singly reaches nearly its saturation value at energies of the primary radiation between 4 and 8 bev. The production of mesons in the interaction of cosmic-ray particles with a liquid-H_2 target was investigated at 90,000 ft. It is estimated that the events in H_2 resulted mostly (80%) from the interaction of primary protons of an average energy of 50 to 100 bev in which a minimum of four mesons were produced. Penetrating showers in Pb were investigated at $\lambda = 55$ and 28°.

2405

ABSORPTION ANALYSIS OF THE STAR-PRODUCING COMPONENT OF COSMIC RADIATION. E. Schopper, K. H. Höcker, and E. Rössle. Z. Naturforsch. 6a, 603-13(1951) Nov. (In German)

The number of stars produced behind Pb, Fe, and graphite absorbers at 2950 m was measured. For Pb and Fe a transition effect appeared in the star frequency with an increase of 35% for 1.2 cm of Pb or 4.5 cm Fe. Both maxima were attributed to photon production. The number of stars produced in air by photons was 10% of the total frequency; this is compatible with the known cross section for photon production of stars and the intensity of the photon component. Height, position, and shape of the maxima were in agreement with cascade theory. Other maxima were noted at 20 cm in Pb and at 18 to 20 cm in graphite.

2406

ON THE DECAY OF V^0 PARTICLES. Martin Deutschmann. Z. Naturforsch. 7a, 142-3(1952) Jan. (In German)

Seven V^0 particles were observed in a cloud chamber fitted with Pb, paraffin, and graphite plates. In five cases it was possible to locate the source. Of these, three showed $p + \pi^-$ decay with lifetimes of (5.7 ± 0.9) (4.2 ± 0.6), and $(3.3 \pm 0.4) \times 10^{-10}$ sec. The other two decayed into two mesons with lifetimes of (1.9 ± 0.3) and $(2.4 \pm 0.5) \times 10^{-10}$ sec. No other type of decay could be observed. 2 figures.

2407

A WORLD-WIDE LOCAL-TIME DAILY VARIATION IN COSMIC RADIATION DURING SMALL DISTURBANCES IN THE EARTH'S MAGNETIC FIELD CAUSED BY CORPUSCLES. A. Ehmert and A. Sittkus. Z. Naturforsch. 6a, 618-22(1951) Nov. (In German)

A characteristic daily cycle was observed in the intensity of cosmic radiation during weak magnetic disturbances caused by solar eruptions. Comparative investigations in ionization chambers and coincidence counters indicated that probably two types of variation were occurring. The appearance and even the extent of these variations were world-wide phenomena, as observed in Tokyo and Germany. The pattern was related to local time.

2408

TRANSITION EFFECT FOR NEUTRON PRODUCTION IN LEAD. S. B. Treiman and W. Fonger. Phys. Rev. 85, 364-5(1952) Jan. 15.

Measurements have been made of the absorption in Pb of the neutron-producing component of cosmic radiation. Varying thicknesses (0 to 10 cm) of Pb absorber were placed above a large paraffin block within which were imbedded a Pb "neutron producer" ½ in. in thickness and three BF_3 proportional counters. The production rate of neutrons in the producer was determined as a function of absorber thickness. The tabulated and plotted data indicate a transition maximum at zero absorber thickness; thus the transition maximum for neutron production per unit volume of Pb must occur within the first ½ in. of Pb. An exponential function provides a good fit to the data for absorber thicknesses > 1.2 cm.

2409

A SOLAR COMPONENT OF THE PRIMARY COSMIC RADIATION. J. A. Simpson, W. Fonger, and L. Wilcox. Phys. Rev. 85, 366-8(1952) Jan. 15.

Preliminary report is made of investigations of time-dependent changes of intensity of the low-energy primary cosmic radiation. Continuous observations were made at different geomagnetic latitudes and altitudes by measuring the disintegration-product neutrons from the local production of small stars in Pb. The intensity data show a remarkable recurrence of series of maxima with each series having a 27-day period. Since the sun has a 27-day spin at low latitudes, the cosmic-particle intensity maxima have been identified with local active regions on the sun at central meridian within ±1 day.

CRYSTALLOGRAPHY AND CRYSTAL STPUCTURE

2410

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

A STUDY OF ORGANIC SCINTILLATORS, by Raymond C. Sangster. Jan. 1, 1952. 109p. (NP-3598; Technical Report No. 55; U20735)

The scintillation-counting properties of 27 purified crystalline derivatives of naphthalene and biphenyl were investigated. Scintillation average pulse heights of single crystals were determined at 30 and -70°C by the use of a C-7140 photomultiplier tube and Co^{60} γ-ray excitation. The fluorescence spectra were measured with an automatic-recording grating spectrograph, the 2537- to 3132-A Hg lines being used for excitation and a C-7140A tube for detection. Scintillation decay times are tabulated for the better scintillators, including 6 compounds in the naphthalene group and 10 in the biphenyl group. Quaterphenyl, diphenylene oxide, carbazole, pyrene, and diphenylbutadiene gave pulses larger than those of stilbene and inferior only to those of anthracene. The first 3 compounds also had short decay times and were generally suitable for counting purposes. A qualitative investigation indicated that strongly colored compounds are poor scintillators and a correlation exists between ultraviolet-excited fluorescence intensity and scintillation response. Scintillation behavior was interpreted in terms of molecular structure on the basis of steric hindrance and quantum mechanical resonance, with the temperature variation of scintillation response being correlated with the vibrational freedom of the molecule. The best crystalline organic scintillators are colorless substances with high m.p.'s; they possess molecules of simple structure with resonance conjugation of rings, ethylenic double bonds, and other groups to give extended, rigidly interlocked systems. The higher diaryl ethylenes should be good scintillators, and the higher polyphenyls better than any organic scintillators known. Purification and crystal-growing techniques, the scintillation-counting apparatus, and a mathematical analysis of pulse distribution curves are considered in the appendixes. (NRS abst.)

2411

[Argonne National Lab.]

ON THE ANOMALOUS TRANSPARENCY OF THICK CRYSTALS TO X-RAYS, by W. H. Zachariasen. Feb. 5, 1952. 8p. (AECU-1909; UAC-508)

Quantitative experimental studies of the anomalous transparency of thick, perfect crystals to a beam of x rays producing "Laue case" diffraction have been reported by Borrmann (Z. Physik 127, 297(1950)) and Campbell (J. Applied Phys. 22, 1139(1951)). The complete theoretical solution for Laue case diffraction in a perfect crystal was reported by Zachariasen in Theory of X-Ray Diffraction in Crystals (New York, John Wiley and Sons, Inc., 1945). It is the purpose of the present paper to compare the theoretical and experimental diffraction patterns. Excellent agreement is demonstrated.

ELECTRONS

2412

THE LATERAL DISTRIBUTION OF IONS ACROSS THE TRACK OF AN IONIZING PARTICLE. PART II. FURTHER CONSIDERATION OF THE EQUILIBRIUM DISTRIBUTION. John Read. Brit. J. Radiology 24, 345-7(1951) June.

The electrons ejected from the positive ions along the track of an ionizing particle migrate some distance from the axis of the track while their energies are reduced to thermal values. They may then be captured to produce negative molecular ions. The separation of charge due to this migration creates a radial electric field, which in the case of α-ray tracks in liquids is very great. It seems possible, therefore, that electrons migrating from an α-ray track are drawn back toward the axis to a greater extent than are those from an electron track so that the negative molecular ions are produced closer to the axis. Support for this is provided by a calculation of the equilibrium distribution established in a liquid between the attraction of the positive core of the track and the dispersive action of thermal agitation. There is a critical linear ion density below which no equilibrium is possible. When the linear ion density is greater than the critical number, this number migrates away from the track, but the excess can form an equilibrium distribution. As the excess increases the electrons group themselves to an increasing extent in the immediate vicinity of the track. Only the ends of electron tracks and of the associated δ-ray tracks have a linear ion density in liquids of the order of the critical value, whereas the whole of an α-ray track has a greater value, at normal temperatures. (auth)

GASES

2413

THERMAL DIFFUSION IN H_2-D_2 AND H_2-He MIXTURES AT LOW TEMPERATURES. A. De Troyer, A. Van Itterbeek, and A. O. Rietveld. Physica 17, 938-42(1951) Nov.-Dec. (In English)

Measurements on thermal diffusion in the binary gas mixtures H_2-D_2 and H_2-He were carried out between room temperature and liquid O_2 or liquid H_2 temperatures. For both mixtures was found a change of the thermal-diffusion coefficient at the lowest temperatures and a change of the sign of this coefficient. (auth)

INSTRUMENTS

2414

California Univ., Los Angeles

AN AUTOMATIC GEIGER-MUELLER TUBE TESTER, by George H. Streit and W. R. Kennedy. Issued Feb. 28, 1952. 10p. (UCLA-186)

A design for a G-M tube tester which automatically plots the characteristic curve of count rate against tube potential is described. The instrument has been designed to accommodate a number of G-M tubes with different operating voltages. The complete circuit is given as well as a discussion on the circuit operation. Means are incorporated to protect the tube at the high voltage end of the plateau by automatically dropping the voltage when the count rate rises to a predetermined level. The instrument has been useful to rapidly separate tubes with poor plateau characteristics from those which with further detailed tests would come up to laboratory standards. A record obtained from a G-M tube is shown. (auth)

2415

Radiation Lab., Univ. of Calif.

A VOLTAGE INTEGRATOR FOR MAGNETIC FIELD MEASUREMENTS, by L. Jones and J. W. Rose. Feb. 13, 1952. 23p. (UCRL-1677)

A voltage integrator is described which can be used to measure magnetic fields. Since the emf induced in a coil is proportional to $d\Phi/dt$ (where Φ is the magnetic flux through the coil), a device which will give an output proportional to the time integral of the emf across the coil can be used to plot magnetic fields directly. This integrator has been used to make such plots to an accuracy of 1% over the range of 500 to 15,000 gauss.

2416

Radiation Lab., Univ. of Calif.

PULSE TRANSFORMERS DESIGN; 300 KV IN 1/10 OF A MICROSECOND, by Robert E. Heller. Feb. 1952. 19p. (UCRL-1674)

Fundamental design considerations for a high-voltage pulse transformer are discussed. It is explained how an optimum design can be accomplished for a given set of specifications through proper field distribution of the transformer windings and other transformer geometry. The resultant unit is a high-speed, high-voltage, low-impedance transformer which can be quite small because of its excellent heat-dissipating ability. Descriptions and photographs are included of several pulse transformers designed at the Univ. of Calif. Radiation Lab. The rise time of one such device is ~0.1 μsec; the pulse length is 0.5 μsec; and the internal impedance is ~1100 ohms. Operating voltages of 300 to 400 kv are used daily, and observations have been conducted in the 600 to 700 kv range with no spark-over or damage to the pulse transformer.

2417

ON THE METHODOLOGY OF ATMOSPHERIC ELECTRICAL POTENTIAL MEASUREMENTS; EFFECT OF WIND ON RADIOACTIVE COLLECTORS. R. Mühleisen. Z. Naturforsch. 6a, 667-71(1951) Nov. (In German)

In observations on daily variations in atmospheric potential, it was noted that the ionization caused by the radioactive collector changed the conductivity of the surrounding air in the direction of the wind. This led to variations in the collector potential. In order to investigate the size of this effect, two identical apparatus, each consisting of a Po-activated probe, high-resistance tube voltmeter, and recording galvanometer, were separated by up to 25 m. Comparison of the two potential registrations showed that variations up to 30% occurred at low wind velocities in the direction of the potential gradient.

ISOTOPES

2418

Research Foundation, Ohio State Univ.

PROPERTIES OF HELIUM THREE AT LOW TEMPERATURES, by J. G. Daunt. [nd] 123p. (AECU-1915)

A comprehensive survey is presented of the literature on He^3. Over a hundred experimental and theoretical investigations are discussed, and data are accumulated on properties of pure liquid and solid He^3 and solutions of He^3 in He^4. Plots of distribution coefficient vs. temperature for various concentrations of solutions of He^3 in liquid He^4, as determined by H. S. Sommers, are presented in advance of publication of the full paper.

ISOTOPE SEPARATION

2419

THE ISOTOPE SEPARATOR OF THE COMMISSARIAT A L'ENERGIE ATOMIQUE. René Bernas. J. phys. radium 13, 73S-74S(1952) Jan. (In French)

A 60°-sector mass spectrometer used for stable-isotope separation is described briefly. The electromagnet weighs 5 tons and requires a current of 20 amp at 600 v. A maximum field of 12,000 gauss is obtained in the 66-mm gap between the 40-cm-diameter pole faces, which serve as walls of a vacuum chamber. The ion source is a cold-cathode discharge at 10^{-3} mm Hg in a magnetic field. Ion currents, under 30-kv tension, of 7 to 12 ma are obtained. In the case of argon, the ratio of ions to neutral molecules is 33:100. Separating power is ~80, and is to be raised to 150. The rate of isotope separation is ~0.001 gm-atom per 24 hr.

MASS SPECTROGRAPHY

2420

Argonne National Lab.

SYSTEMATIC ERRORS IN ISOTOPE ANALYSIS INTRODUCED BY MASS SPECTROMETER GAS SAMPLE SYSTEMS, by Richard J Hayden. Jan. 30, 1952. 8p. (AECU-1911; UAC-506)

An arrangement characteristic of the gas inlet system and ionizing region of a mass spectrometer is assumed in the derivation of the systematic errors in isotope analysis introduced by mass spectrometer gas sample systems. In the course of the derivation an expression is obtained which enables the calculation of the actual isotope abundance in a sample from the observed abundance.

2421

MASS DEPENDENCE OF ELECTRON RELEASE BY ISOTOPE IONS. Werner Ploch. Z. Physik 130, 174-95(1951). (In German)

The emission of electrons by Pt, Mo, and Be and Cu bombarded with Li^6, Li^7, Ne^{20}, Ne^{22}, K^{39}, and K^{41} was measured with a mass spectrometer. Reflection of the ions also was determined. Both phenomena exhibited a notable mass dependence with isotopes of equal energy. Various models of the electron-release mechanism are discussed on the basis of a purely velocity-dependent law. For similar electron configurations a simple relation is shown to exist between electron emission and ionic radius. A method of correcting for mass differences in the measurement of isotope ratios with electron multipliers is described.

2422

A NEW METHOD OF MEASURING THE ION CURRENT OF MASS SPECTROMETERS. Itaru Nonaka, Shinpachi Hirasawa, and Kazushige Tsutsumi. J. Phys. Soc. Japan, 466-72(1951) Nov.-Dec.

In most mass spectrometers the ion current received by the collector is measured by d-c amplifiers, but it is preferable to use a-c amplifiers, if possible, because in a-c amplifiers there is no zero point drift and the number of stages can be easily increased. An a-c amplifier in a mass spectrometer of Nier type was used. The ion current was pulsed by giving the potential of the first slit, which pulls out the ions from the ion source, a rectangular wave form of −4 volts and +1 volt relative to the ion-source chamber. The ion current amplified by a three stage a-c amplifier of 110 db was rectified and then measured by a d-c milliammeter of 1-ma full scale. The amplifier was very stable and the current amplication factor was about 0.7×10^{10}, the minimum ion current detectable at the collector being about 1.5×10^{-15} amp. (auth)

2423

MASS-SPECTROGRAPHIC STUDY OF IONIC REACTIONS IN HYDROGEN. Raymond L. Murray. J. Applied Phys. 23, 6-10(1952) Jan.

An analysis of the ratios of the di- and tri-atomic ions of hydrogen, deuterium, and H−D mixtures obtained from a hot-cathode arc discharge in a magnetic field was used to examine the nature of ionic collision and displacement processes. Ion mobility, and consequently the rate of ion-molecule collisions, at constant pressure, were controlled by varying the intensity of the magnetic field. Statistical treatment of mass-spectrograph data indicates that the formation of H_3^+ is due to the reaction $H_2^+ + H_2 \rightarrow H_3^+ + H$ and that the ion rather than the molecule undergoes dissociation on collision. (auth)

MATHEMATICS

2424

Wright Air Development Center

A NEW LINEAR OPERATIONAL CALCULUS, by Frank W. Bubb. May 1951. 41p. (AF-TR-6581)

2425

Massachusetts Inst. of Tech.

APPROXIMATE ANALYTICAL METHODS FOR DETERMINING NATURAL MODES AND FREQUENCIES OF VIBRATION, by J. W. Siddall and G. Isakson. Jan. 16, 1951. 186p. (NP-3117)

2426

ON STATISTICAL ANALYSIS OF THE RESULTS OF MEASUREMENTS OBTAINED WITH GEIGER COUNTERS. L. Mezzetti and R. Querzoli. Rend. ist. super. sanità 14, 944-50(1951). (In Italian)

A formula giving the probability that a shower of N particles will discharge x out of n counters is derived.

MEASURING INSTRUMENTS AND TECHNIQUES

2427

Oak Ridge National Lab.

DEPTH DOSE RELATION FOR BIOLOGICAL MATERIALS EXPOSED TO BETA RAYS (abstract), by E. B. Darden, Jr. and C. W. Sheppard. [nd] 1p. (AECU-1899)

To provide more precise quantitation of energy absorption in biological material exposed to thick sources of P^{32} beta rays, the dose rate was determined at various depths in phantoms constructed from plane sheets of tissue-equivalent plastic. By a well accepted physical technique, using the extrapolation chamber, the dose rate I at a given depth can be related to the rate I_0 at the surface. Results for several plastics of varying chemical structure yielded essentially identical values when the depth t of the absorber was expressed not in linear units but in grams of intervening material per square centimeter. Using these units the relation was found to be accurately expressed by the equation

$$\log_e(I/I_0) = -9.50\,t + 1.45\,t^2 - 8.80\,t^3.$$

Because of the uniformity of results in various low atomic number materials, the relation should hold accurately for tissue also. These results provide a useful method of determining energy absorption from beta rays in experiments of the type performed by Gaulden et al., on the developing neuroblast cells of *Chortophaga viridifasciata*, and described elsewhere in this meeting. (Entire report. Abstract of paper for Atlanta meeting of Association of Southeastern Biologists, April 18-19, 1952)

2428

Radiation Lab., Univ. of Calif.

RESOLVING TIME OF THE SCINTILLATION COUNTER, by R. F. Post. Radiation Lab., Univ. of Calif. and Stanford Univ. Feb. 14, 1952. 11p. (UCRL-1675)

The general aspects of resolving time limitations set by fluctuation phenomena in the scintillator are discussed. A solution to the optical problem of the time-intensity distribution of scintillations transmitted through a light pipe is sketched. This solution is then used to compute the resolving time broadening due to the effect of the light pipe. It is shown that a broadening of the order of a factor of two or more can occur with light pipes of moderate length. An extimate is then made of the limiting resolving times which might be obtained at present. These turn out to be approximately 3×10^{-10} second with no light piping, and correspondingly longer with light pipes. The possibility of counting Cherenkov radiation to obtain short resolving times is indicated, and ways are indicated whereby the above limiting times might be reduced. (auth)

2429

Oak Ridge National Lab.

MONITORING OF LIQUIDS FOR RADIOACTIVITY, by W. M. Hurst. Issued Mar. 11, 1952. 34p. (ORNL-1155)

The development of an instrument to monitor continuously drinking water for alpha-beta-gamma radioactivity in solution has progressed so that a preliminary design and some test results can be presented. Two devices are described: (1) the continuous-flow water cell with the radiation detector assembly, and (2) an instrument, for calibrating the water cell and detector response, which instrument can also be used to measure the activity of liquid samples. A Geiger counter is surrounded but not in contact with a rapidly rotating cylindrical wall of water of one-cm radical thickness. K^{40} naturally present in body fluids of the human being is detected easily. Sr^{39} activity in water is detected at a concentration of 1×10^{-6} μc/cc, Tl^{204} at a concentration of 3×10^{-6} μc/cc. Alpha radiation (from Pu^{239}) is detected at 4×10^{-5} μc/cc. Operation for one hour with a solution having a Sr^{90} (plus Y^{90} in equilibrium) activity of 10^{-1} μc/cc resulted in no measurable contamination of the counter tube. (auth)

2430

[Argonne National Lab.]

SOME OBSERVATIONS ON PULSE HEIGHT RESOLUTION AND PHOTOSENSITIVITY, by Robert K. Swank and Warren L. Buck. Feb. 1952. 14p. (AECU-1908; UAC-509)

The pulse height resolution of a scintillation counter has been measured and plotted for several pulse heights. It was noticed that for small pulse heights the relationship is linear, while at larger pulse heights, the curve bends over, and would presumably level off to a saturation value. The effect of the source width was to displace the curve vertically rather than to distort its shape. By extrapolation a value of the source width can be obtained. This extrapolated source width corresponds to a limiting value of 20,400 for the resolution of source.

2431

[Argonne National Lab.]

PACKAGING OF NaI(Tl) CRYSTALS FOR SCINTILLATION SPECTROMETRY, by R. K. Swank and J. S. Moenich. Feb. 1952. 4p. (AECU-1905; UAC-513)

A package for NaI(Tl) crystals consisting basically of an aluminum can with a glass or quartz window is described. A polymerizing synthetic-rubber sealer was found to be excellent for bonding the aluminum flange to the glass, while vinyl acetate has the required optical properties and provides an elastic bond to the glass to hold the crystal in place. MgO powder was found to be the best reflector for backing of the crystal. This assembly was found to be satisfactory for the requirements of scintillation spectrometry as well as ordinary γ counting.

2432

[Argonne National Lab.]

A VERSATILE LABORATORY SCINTILLATION COUNTER, by R. K. Swank and J. S. Moenich. Feb. 1952. 3p. (AECU-1907; UAC-514)

A design is described of a standard scintillation detector assembly with interchangeable phosphors found to satisfy about 50% of the needs without modification and another 25% with modification. Requirements for a satisfactory counter assembly are given.

2433

Argonne National Lab.

A SELF-DELAYED COINCIDENCE CIRCUIT, by M. Freedman. May, 1951. 9p. (AECU-1912; UAC-517)

Design of a self-delayed coincidence circuit for a scintillation detector is reported. A block diagram of the circuit is included. When used with thalliated K iodide, a high counting efficiency for low-energy β particles is reported.

2434

Argonne National Lab.

LONG-LIVED PHOSPHORESCENCE OF KI-TlI, by Bernard Smaller. Dec. 1951. 12p. (AECU-1910; UAC-504)

The long-lived decay of Tl-activated KI has been investigated with Co^{60} radiation as the exciting source and a photomultiplier tube in the detecting system. The graph of output intensity after irradiation as a function of time for three different temperatures is analyzed into one to five exponential components, and the temperature dependence of the decay of each component is indicated. By assuming that the total integrated intensity from each trap is the same as that for shorter-period decay, the decay time for each was approximated. This assumption implies that the probability for electrons to fall into any given trap would be the same for all trap levels; i.e., $n_i \sigma_i$ = constant, where n = number of traps and σ = cross section for trapping. The phenomenon of thermoluminescence is discussed in terms of cross section and number of traps. For the first four indicated traps, both the number and cross section were found to be substantially equal and the value of $n\sigma$ was nearly independent of temperature.

2435

National Bureau of Standards

METHOD AND INSTRUMENT FOR THE MEASUREMENT OF MICROPHONIC EFFECTS IN MICROWAVE TUBES, by Guy F. Barnett. April 2, 1951. 7p. (NBS-1076; U20736)

A system is described for obtaining quantitative values of the microphonic output of X-band klystrons. The tube under test is mounted on a permanent-magnet dynamic speaker driven by an audio oscillator and amplifier. The tube output is picked up by a horn or some means which will not mechanically load the speaker. Most of the output is fed into a crystal rectifier after going through an attenuator consisting of an elliptical attenuator card rotated by a motor. While rotating, the card dips into and out of the wave guide, causing the attenuation to vary from 0 to any arbitrary attenuation up to 3 db. Thus, the output from the crystal as seen on a cathode-ray oscillograph (CRO) with the calibrator operating is known. With the calibrator turned off and the tube under test vibrating, the amplitude of the signal on the CRO is compared to that which appeared when the calibrator was operating; a measure of the amplitude modulation experienced by the tube is obtained. For measurement of the microphonic frequency modulation (f-m), a small portion of the tube output is taken off by means of a directional coupler and fed into a crystal rectifier along with a signal from a local oscillator (LO). The LO and f-m CRO horizontal deflection plates are fed from the same sawtooth sweep generator. The crystal output is fed simultaneously into a 20 mc i-f amplifier having a 50 kc bandwidth and a gain of 17,000 and a 1 mc i-f amplifier having a 15 kc bandwidth and a gain of 3700. After amplification each signal is put through a diode detector, an r-c differentiating circuit, and a germanium crystal detector. The signals are then fed simultaneously to the vertical deflection plates of the f-m CRO. The resulting pips on the CRO are used to calibrate the CRO screen in megacycles, after which the f-m of the tube can be determined. (NRS abst.)

2436

Los Alamos Scientific Lab.
AFTERPULSING IN PHOTOMULTIPLIERS, by Donald W. Mueller, George Best, Jasper Jackson, and John Singletary. [nd] 10p. (AECU-1926; LADC-1121)

An attempt was made to determine the source of the afterpulse in photomultiplier tubes. An observed feedback to the cathode was found related to the afterpulses.

2437

RADIATION MEASURING INSTRUMENTS FOR X-RAYS TO COSMIC RAYS. D. Taylor and W. Abson. Proc. Inst. Elec. Engrs., 760-70(1951) Dec.

The paper is a review of the techniques used in the detection and measurement of very-short-wave radiations (X-rays and γ-rays) and nuclear and cosmic particles (α-particles, β-particles, protons, neutrons and mesons). The radiations and particles are classified under three headings—X-rays and γ-rays, charged particles, and uncharged particles; in each case an account is given of the more important measurable quantities (e.g. energy, W, flux of radiation, Φ, radiation dosage, r, etc.) and the physical basis of the method of measurement involved. The examples chosen to illustrate these techniques are process instruments developed at the Atomic Energy Research Establishment to provide continuous monitoring of α- and β-activities in solution. In the α-activity monitoring instrument the pulse technique is used for recording individual particles, whereas in the β-activity instrument the mean rate of ionization in an ionization chamber is measured as a direct current. Complete descriptions are given of both instruments, together with details of the performance characteristics obtained. The paper ends with a discussion of nucleonic-instrument design, and a number of aspects receive special mention, namely source-detector geometry, detectors in assay instruments, special problems associated with portable instruments, and, lastly, materials and finishes for radioactive-contamination monitoring instruments. (auth)

2438

"AIR EQUIVALENCE" OF SCINTILLATION MATERIALS. William B. Ittner, III and Michel Ter-Pogossian. Nucleonics 10, No. 2, 48-52(1952) Feb.

The air equivalence of common scintillators is discussed from the standpoint of energy absorption and crystal response. Methods of simulating air equivalence presented include use of natural materials, compounding two or more crystals, and sizing of crystals combined with compounding crystals. Advantages of the scintillation dosimeter over the Victoreen chamber are listed.

2439

CO_2 ION-CHAMBER TECHNIQUES FOR RADIOCARBON MEASUREMENT. Gordon L. Brownell and Helen S. Lockhart. Nucleonics 10, No. 2, 26-32(1952) Feb.

This review of measurement of $C^{14}O_2$ with ionization chambers includes ionization chamber theory and design, current measurement theory, and techniques of filling the chamber and measuring the activity.

2440

CONSTANT GEOMETRY FOR DEAD-TIME DETERMINATIONS. Luther E. Preuss. Nucleonics 10, No. 2, 62-3 (1952) Feb.

Dead-time determinations for G-M counters involve measurement of separate and combined counting rates of two sources. A method of reproducing geometry for the three counting rates is described in which a flat Cu planchet is cut into halves, notched, and held in place by notches in the planchet holder. Aliquots of radioactive solution can be pipetted onto each half. A diagram of the apparatus is shown.

2441

ON THE INCLUSION OF Tl^+ IN NaCl AND KCl. Peter Brauer. Z. Naturforsch. 6a, 560-1(1951) Oct. (In German)

Crystals precipitated from an aqueous solution of KCl containing TlCl will include Tl in the crystal lattice and will fluoresce. If NaCl is substituted for the KCl, the Tl remains in the mother liquor. The author calculates, by theoretical considerations of lattice energy, heat of hydration, etc., the reaction energy of the process to be 0.79 ev for NaCl and −0.06 ev for KCl, thus satisfactorily explaining the difference in behavior. The feature principally responsible is the energy required to replace a Me^+ ion with Tl^+ in the lattice: 2.09 ev for NaCl, 0.37 ev for KCl.

2442

CALCULATION OF THE ELECTROSTATIC FIELD OF A MULTIWIRE ANTICOINCIDENCE COUNTER TUBE. Alfred Seeger. Z. Naturforsch. 6a, 688-94(1951) Nov. (In German)

Equations for the electrostatic field of an anticoincidence counter tube consisting of inner and outer cylinders, between which were arranged six counter wires, are derived with the aid of θ functions.

2443

INVESTIGATION OF A GEIGER-MUELLER COUNTER WITH MANY COUNTER WIRES. H. Jürgensen and H. M. Weiss. Z. Naturforsch. 6a, 694-8(1951) Nov. (In German)

The counting properties of an anticoincidence counter with many wires between plane or concentrically curved plates were investigated with regard to use as a large-surface counter. The discharge was not localized in the counting region of the individual wires; the overlapping was studied. As a practical application, an anticoincidence detector consisting of a multiwire annular-ring counter enclosing a central-wire counter is described for low-intensity counting.

2444

MOLDED MULTI-CRYSTALLINE STILBENE FOR SCINTILLATION COUNTING. Earle C. Farmer and Irving A. Berstein. Nucleonics 10, No. 2, 54-6(1952) Feb.

The scintillation properties of various forms of stilbene (single-crystalline, multi-crystalline, and powdered) are compared. For applications dependent upon the integrated light output of the phosphor, multi-crystalline stilbene is as satisfactory as single-crystalline up to a thickness of about 1½ cm. Preparation of molded multi-crystalline stilbene is described.

2445

ELIMINATION OF THE CONTRACTION OF NUCLEAR EMULSIONS. G. Mignone. Nuovo cimento 8, 896-7(1951) Nov. 1. (In Italian)

The errors incident to contraction of nuclear emulsions on drying, particularly noticeable when the emulsion had been bent into cylindrical shape, were avoided by immersing the dried emulsion in a solution of glycerin and permitting sufficient impregnation to annul the contraction. Conditions of the treatment are discussed, and the increase in accuracy obtained on measuring the ranges of α particles is shown.

2446

A SOCIETÀ ITALIANA DI RADIOLOGIA MEDICA PRIZE-WINNING INTEGRATING RADIOLOGICAL DOSIMETER. Franco Fossati and Luigi Terra.. Radiologia med. (Milan) 38, 26-33(1952) Jan. (In Italian)

A dosimeter for use in contact or deep therapy with x or γ rays is described. It is self-reading in r units and is designed to interrupt the h-v circuit of the x-ray tube. The ionization chamber is of either thimble or flat type. 6 figures.

2447

AN ELECTRONIC DISCHARGE-CONTROL CIRCUIT FOR NON-SELF-QUENCHING GEIGER-MUELLER COUNTERS. R. Salin and A. Moussa. J. phys. radium 13, 80S(1952) Jan. (In French)

A brief description of a circuit designed to lower the counter voltage below the threshold immediately following the discharge avalanche and during the sweeping of positive ions is given.

MESONS

2448

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF NOVEMBER 29, 1951, by S. Shewchuck. Jan. 24, 1952. 12p. (UCRL-1650)

Meson Scattering Experiments, by R. Jastrow. Measurements made at Chicago on the cross section for π^- scattering on H are reported as follows: 50 ± 6 mb at 135 Mev, 65 ± 4 mb at 176 Mev, and $\leq$ 60 mb at 210 Mev. The angular distribution of π^+ and π^- mesons scattered from C has been investigated at the Nevis cyclotron; the π^- cross section is larger in the small-angle range, indicating that the meson interaction is attractive and that the many-body problem works against the saturation of forces. Columbia also found the ratio of π^+ to π^- total cross sections to be 1.6 ± 1 at 80 Mev. Differential Analyzer Methods for Orbit Problems in the Cyclotron and a Proposed Meson Beam, by B. Rankin. An Analyzer with selsyn drives, which utilizes the principle of using two wheels as an analog to integration, has been designed and found to be capable of solving equations of motion of a charged particle in an axially symmetric magnetic field. The setting up of problems for the analyzer is discussed, and the wiring diagram for one problem is presented. Incomplete investigations indicate the possibility of getting a good π^- beam outside the tank. Deuteron Photodisintegration, by W. Gilbert. This talk was based on UCRL-1590 (NSA 6-1863).

2449

Rochester Univ.

DECAY OF THE K MESON, by A. M. L. Messiah. Nov. 27, 1951. 4p. (NYO-3036)

By assuming the K meson ($\sim 1200\ m_e$) to be a spin-½ particle whose decay takes place through a Fermi-type interaction, the spectrum of the charged decay particles is calculated for the following decay schemes; (1) $K \rightarrow \mu + 2\nu$ and (2) $K \rightarrow e + 2\nu$. It is found that the mean kinetic energy T of the decay particle is rather insensitive to the relative values of the coupling constants. In process (1) T_μ is between 1 and 1.5 times the energy of the μ meson (mass ratio $K/\mu = 6$ is assumed); in process (2), T_e lies between 180 and 240 Mev. The lifetime for decay by each process is calculated, after postulating the existence of a Universal Fermi interaction, and the total lifetime of the K meson is estimated as 10^{-10} sec. One case of "odd" coupling is considered briefly, with the results $T_e = 180$ Mev and $T_\mu = \mu$.

2450

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF JANUARY 3, 1952, by Sergey Shewchuck. Feb. 12, 1952. 9p. (UCRL-1660)

Study of Isotopes of Pm, by Vera K. Fischer. This talk was based on UCRL-1629. Excitation Functions for Meson Production by Protons on Protons, by A. Schulz. (cf. UCRL-1433). Report is made of experimental results to date on the $p + p \rightarrow \pi^+ + d$ reaction. Graphs of cross section vs. meson energy are presented for π^+ production in polyethylene and in C for proton energies of 336, 326, and 315 Mev. The excitation function is shown for proton energies of 290 to 340 Mev.

2451

ON THE DECAY OF μ-MESONS. R. Levi Setti and G. Tomasini. Nuovo cimento 8, 994-1005(1951) Dec. 1. (In English)

From multiple scattering measurement in nuclear emulsions an energy spectrum of the decay particles of the μ mesons is obtained. The results are analyzed with particular regard to the high-energy region of the spectrum and then are compared with the results reported by other authors. From comparison with the magnetic deflection measurements in a Wilson chamber it is possible to estimate the reliability of the results obtained from scattering measurements and to obtain information on the validity of the scattering theory of Williams-Molière, for the energy interval relative to the considered spectrum. Some examples are described of annihilation and brehmsstrahlung processes which support the hypothesis that the μ-decay particles are of mass very close to that of the electron. (auth)

2452

ABSORPTION OF SLOW μ-MESONS IN NUCLEAR EMULSIONS. A. Bonetti and G. Tomasini. Nuovo cimento 8, 693-704(1951) Sept. 1.

380 cm^2 of 600-μ Ilford G5 plates and 200 cm^2 of 400-μ Ilford G5 plates have been scanned, and 1004 tracks of mesons which stopped in the interior of the emulsion have been observed. The plates were exposed vertically during 6 days at 2900 m above sea level (Pic du Midi), far from heavy materials. The determination has been made of (a) the fraction of μ mesons which undergo β decay, (b) the number of slow electrons associated with the capture of μ mesons, and (c) the energy distribution of the slow electrons. (auth)

2453

ON MULTIPLE PRODUCTION OF MESONS IN NUCLEON-NUCLEON COLLISIONS. M. Teucher. Naturwissenschaften 39, 68-9(1952) Feb. (In German)

An event observed in an Ilford G5 plate exposed in a balloon flight at 15 to 18 km is illustrated. An incident particle of minimum ionization and calculated energy of $(5 \pm 1) \times 10^{10}$ ev produced 20 particles, presumably π mesons, a minimum ionization emerging in a forward cone. The energy was calculated on the assumption of pure multiple production. Two electron pairs indicative of π^0 meson decay also were detected.

2454

REMARKS ON THE THEORY OF MULTIPLE PRODUCTION OF MESONS. W. Heisenberg. Naturwissenschaften 39, 69 (1952) Feb. (In German)

The number of π mesons produced in the nucleon-nucleon event reported by Teucher (preceding abstract), as well as in multiple meson production observed by other authors, is too high to be explained by Fermi's theory (Phys. Rev. 81, 683(1951)), in which the degree of energy dissipation and number of mesons are determined by the volume in which temperature equilibrium occurs. The process of multiple meson production is highly dependent on a collision parameter, a center-line collision in particular producing many more mesons than indicated by Fermi's theory.

2455

DECAY OF NEUTRAL MESONS. Reinhard Oehme. Z. Naturforsch. 7a, 55-60(1952) Jan. (In German)

The probability of decay of a neutral meson with 0 spin into electron and positron is shown, on the basis of general invariance properties, to vanish exactly when expressed as a function of the square of the fine-structure constant α, that is, in any approximation relative to meson-nucleon interaction. This is valid for neutral pseudovector mesons, whereas the matrix element of lowest order is non-zero for vector mesons. These selection rules are valid independently of the mass of the neutral meson. The most probable decay mechanism for spin-0 mesons is transition into γ quanta. Vector π^0 mesons decay preponderantly into electron-positron pairs. A decision can not be made on whether pseudovector-meson decay into an electron-positron pair plus one γ quantum or into three quanta is more probable; the possibility of resolution of this point by experimental means is discussed.

2456
MULTIPLE PRODUCTION OF MESONS. D. Ivanenko and V. Lebedev. Doklady Akad. Nauk S.S.S.R. 80, 357-60(1951). (In Russian)

A phenomenological theory is presented of multiple meson production as a process of the same order of energy as the coupling between nucleon and meson, which for simplicity is considered as neutral and scalar.

2457
ANTIPROTON ANNIHILATION. Israel Reff. Phys. Rev. 85, 379(1952) Jan. 15.

The cross section for meson production by proton-antiproton annihilation was calculated by the usual second-order perturbation procedure. The results for both neutral and charged scalar theory with scalar coupling (S-S) and pseudoscalar theory with pseudoscalar coupling (PS-PS) are in agreement with those of Ashkin, Auerbach, and Marshak (Phys. Rev. 79, 266(1950)). Total and differential meson production cross sections for the limits $p \to o$ (p = nuclear momentum) and $p \to \infty$ are tabulated for interactions of the following types (both neutral and charged): PS-PV, V-V and PV-PV.

2458
CHARGED π-MESON PRODUCTION FROM DEUTERIUM. S. Passman, M. M. Block, and W. W. Havens, Jr. Phys. Rev. 85, 370-1(1952) Jan. 15.

The $\pi^{\pm}$-meson production cross sections from D at $90 \pm 5°$ to a 381-Mev proton beam have been obtained. The $(CD_2)_n$ target was placed radially in the internal circulating beam of the Nevis cyclotron; nuclear emulsions in Cu shielding recorded π-μ decays and π^- stars. The π^+ meson spectrum $d^2\sigma/d\omega dE$ has a maximum in the region between 30 and 50 Mev of $\sim 4.5 \times 10^{30}$ cm^2/Mev/sterad/D nucleus. The integrated cross section $d\sigma^{\pm}/d\omega$ is $(2.9 \pm 1.2) \times 10^{-28}$ cm^2/sterad/D-nucleus. An estimate of the total 90° negative cross section, $d\sigma^-/d\omega$ is $(1.1 \pm 0.9) \times 10^{-29}$ cm^2/sterad/D-nucleus. Possible modes of producing mesons by p + p and p + n are discussed, and theoretical production cross sections calculated by using the impulse approximation are compared with the experimental values.

2459
MESONIC PROPER-FIELD. Hiroomi Umezawa, Yasushi Takahashi, and Susumu Kamefuchi. Phys. Rev. 85, 505-16 (1952) Feb. 15.

A method is presented of treating the meson cloud around the nucleon. The meson cloud is described in terms of the free field operators which coincide, on the world point on the space-like surface, with the usual field operators in the Heisenberg representation. In the second and the third sections, the relation between the field and its source on an arbitrary space-like surface is studied. The fourth and fifth sections are concerned with the method of the phenomenological investigation of the meson cloud in our formalism and with the treatment of the problem of the multiple production of mesons and the magnetic moment of the nucleon-meson system. This treatment of the multiple production of mesons is shown to be the covariant generalization of Bloch-Nordsiecks' method for the multiple production of low energy photons. (auth)

NUCLEAR PHYSICS

2460
NONLINEAR TERMS IN MESON EQUATIONS. Walter E. Thirring. Z. Naturforsch. 7a, 63-6(1952) Jan. (In German)

The effect of nonlinear terms on the saturation of nuclear forces is investigated with a simple nuclear model in view of the nonlinearity indicated by field theory.

2461
MESON THEORY AND SPIN-ORBIT COUPLING IN THE NUCLEUS. Heinrich Gaus. Z. Naturforsch. 7a, 44-55 (1952) Jan. (In German)

The neutral vectorial meson theory, when exchange effects are not considered, gives for the motion of a nucleon in the nucleus a strong spin-orbit coupling corresponding to the Haxel-Jensen-Suess model (Z. Physik 128, 295(1950)) and analogous to the motion of a magnet in an electric field. With the help of the Hartree-Fock equation and representation of the exchange effects by a potential well, spin-orbit coupling and exchange effects are conjoined in vector theory for the charged as well as symmetrical case. Since recent experiments have indicated that π mesons have 0 spin, the possibility of deriving spin-orbit coupling from spin-0 meson fields is discussed; in the pseudoscalar case the perturbation calculation must be carried to higher orders of approximation.

2462
EXPERIMENTAL MEASUREMENTS ON BREMSSTRAHLUNG FROM 17 MEV ELECTRONS. Lawrence Herman Lanzl. Ph.D. Thesis, Univ. of Illinois, 1951.

Several measurements on bremsstrahlung produced by 17-Mev electrons from a betatron were made. The electrons were removed from the betatron by means of a peeler and focused with a magnetic lens. Results of measurements by several methods of the Z dependence of the bremsstrahlung cross section over the upper portion of the spectrum agreed within 1% with the Bethe-Heitler theory. Absolute cross sections for total radiative energy loss agreed roughly with theory. The angular distribution of radiation from foils of various thicknesses was measured with film, ion chamber, and Cu detectors.

2463
THE NUCLEUS. Enrico Fermi. Phys. Today 5, 6-9 (1952) March.

A brief review of the advancements of nuclear physics in the past twenty years is given. The major problem discussed is the understanding of the structure of the nucleus. It was pointed out that without an understanding of nuclear energy levels, interaction of nuclear forces, Yukawa theory, and mesons an understanding of the structure of the nucleus could not be obtained.

NUCLEAR PROPERTIES

2464
Ames Lab.
NEW TECHNIQUE FOR MEASURING PHOTONUCLEAR CROSS SECTIONS AND ITS APPLICATION TO THE $Cu^{63}(\gamma,n)Cu^{62}$ AND $C^{12}(\gamma,n)C^{11}$ REACTIONS, by Lester L. Newkirk and L. Jackson Laslett. Dec. 1951. (ISC-183)

A new technique for the determination of photonuclear cross sections is described in detail. It was applied to the $Cu^{63}(\gamma,n)Cu^{62}$ and $C^{12}(\gamma,n)C^{11}$ reactions from thresholds up to 60 Mev. The synchrotron, which was used to induce the reaction, produced photons which had a continuous distribution in energy up to the kinetic energy of the electrons $E_0 - \mu$, where E_0 is the total electron energy and μ is the rest energy of the electron. Thus $A(E_0 - \mu)$, the reaction rate for photonuclear reaction, is proportional to the integral, from threshold T to $E_0-\mu$, of the product of the cross section $\sigma(k)$ and the photon distribution $P(k,E_0-\mu)$ where k represents the photon energy. Accordingly,

$$A(E_0-\mu) = Na \int_T^{E_0-\mu} \sigma(k)P(k,E_0-\mu)dk$$

where N is the number of atoms/cm² of sample material, and a is the area of the sample. The solution for $\sigma(k)$ is derived after $A(E_0-\mu)$ and $P(k,E_0-\mu)$ are found. The results obtained are consistent and are in good agreement with the results obtained by different methods (Proc. Roy. Soc. (London) 146A, 83(1934); 151A, 479(1935)).

2465
Rochester Univ.
TESTS OF CHARGE INDEPENDENCE FROM PION PRODUCTION IN NUCLEAR COLLISIONS, by A. M. L. Messiah. Mar. 4, 1952. 6p. (NYO-3047)

It is shown how the hypothesis of charge independence of nuclear forces can be tested in experiments on pion production in nuclear collisions. If it is assumed that the total isotopic spin is a good quantum number in reactions involving nucleons and pions only, the cross sections for production of charged and neutral pions in nuclear collisions must satisfy rather stringent relations. By starting with the wave functions of H^3 and He^3 in the final state, from $p + d \rightarrow \pi^+ + H^3$ or $p + d \rightarrow \pi^\circ + He^3$, a relation between the cross sections for π^+ and π° production is derived and is then extended to more general cases in terms of the ratio between the contributions from doublet and quartet transitions.

2466
Argonne National Lab.
CROSS SECTIONS FOR 14 MEV NEUTRONS, by Leonard S. Goodman. Feb. 1952. 14p. (AECU-1913; UAC-511)

Total neutron cross-section measurements have been made for 21 elements from H to Bi by using monoenergetic 14-Mev D-T neutrons. A Zinn-type ion source was used, and the primary target was ZrT. The neutrons were detected by observing pulses due to recoil protons in an anthracene crystal with a 5819 photomultiplier tube; this method was used both for monitoring the source and for the transmission measurements. An evaluation of room scattering, small-angle scattering, and statistical errors is given. The cross-section values with their accompanying errors are tabulated. A plot of $\sigma^{1/2}$ vs. $A^{1/3}$ is included; the points for H, D, Be, and Sb are markedly off the line. The measurements on Zr disagree with Lasday's (Phys. Rev. 81, 139(1951)). No evidence of falling off of cross section for magic-number nuclei was found.

2467
Rochester Univ.
TOTAL CROSS SECTIONS OF CARBON AND HYDROGEN FOR HIGH ENERGY NEUTRONS, by George R. Mott, Gordon L. Guernsey, and Bruce K. Nelson. Jan. 15, 1952. 23p. (NYO-3042)

Measurements of the total cross sections of carbon and hydrogen have been made at neutron energies of 97 ± 5, 117 ± 5, 140 ± 5, 156 ± 5, 180 ± 7, and 220 ± 10 Mev using a calibrated anthracene crystal as an energy sensitive detector for recoil protons. This proportional crystal was used as the fourth of a quadruple-coincidence anthracene scintillation-counter telescope which detected recoil protons scattered at 20° from a polyethylene radiator in the collimated neutron beam from the University of Rochester 130-in synchrocyclotron. The methods employed permit the simultaneous measurement of total cross sections over a continuous spectrum of neutron energies. The results are in general agreement with previously reported data. (auth)

2468
Nuclear Physics Lab., Columbia Univ.
PROGRESS REPORT FOR OCTOBER, NOVEMBER, DECEMBER, 1951 TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Feb. 28, 1952. 28p. (CU-100)

The total cross section of B for thermal neutrons (2200 m/sec) has been redetermined to be $\sigma_{\text{total}} = 754 \pm 15$ barns. The slow-neutron-transmission curves of Ru are shown, and the level strengths of the resonances, as determined by the area method of analysis, are given. Results of a preliminary analysis of slow-neutron resonances in Ta are presented. The 5-ev resonance in Ag has been located in the isotope Ag^{109}. The 2.2-ev resonance in Te is in Te^{123} and the 24-ev resonance in Te^{125}. The weak neutron-capture resonances in Cd from 20 to 200 ev have been found to appear more prominently in capture-gamma than in transmission measurements. Measurements of paramagnetic scattering of neutrons indicate a cross section of about 20 barns for FeF_3 and about 45 barns for the two Fe atoms in $ZnFe_2O_4$. Neutron velocity spectrometer samples of Co, Ag and Te isotopes have been made by electrodeposition. No more than 60% of the Te bath could be plated out for good deposits. Te mirrors have been prepared and found to give good neutron reflection only if highly polished. The decay of RaE(Bi^{210}) was investigated with a very pure source; the absence of an 80-kev γ ray or corresponding conversion electrons was established to 1 part in 10^3.

2469
Johns Hopkins Univ.
ANNUAL REPORT; I. ANGULAR CORRELATION IN $Li^6(d,p)Li^{7*}(\gamma)Li^7$, by S. S. Hanna and C. M. Class and II. MAGNETIC ANALYSIS OF DEUTERON-BERYLLIUM REACTIONS, by S. S. Hanna and R. W. Gelinas. Dec. 1951. 44p. (NYO-3290)

An account is presented of the measurement and analysis of the p-γ and d-γ angular correlations in the $Li^6(d,p)Li^{7*}(\gamma)Li^7$ reaction. Results of calculations of correlation functions are tabulated for various choices of spin for the excited state and for dipole and quadrupole radiation. The experiment was performed with deuterons of energy 600 to 800 kev and enriched Li^6 targets. The protons and γ rays were detected by anthracene and NaI crystals in coincidence. The correlation measurements were obtained by observing the p-γ coincidence rate at six to nine angles of the γ counter between 35 and 145°. In order to obtain additional evidence for the isotropy of radiation from the excited state under study, a brief investigation was made of the angular distribution of such radiation relative only to the direction of the incident deuteron beam. No evidence for an anisotropic distribution of radiation was found, confirming the assignment of $I = 1/2$ to the first excited state of Li^7. The report includes also the investigation by magnetic analysis of the charged particles from the deuteron bombardment of Be. A careful search of the whole available spectrum was made, with particular attention to the background arising from the $Be^9(d,\alpha)H^3 + He^4$ or $Be^9(d,t)He^4 + He^4$ reaction. Broad structure in the triton continum appears in a region corresponding to the 3-Mev state in Be^8. A sharp group of α particles was found corresponding to a 4.7-Mev level in Li^7.

2470
Brookhaven National Lab.
NUCLEAR RECOIL FOLLOWING NEUTRINO EMISSION FROM BERYLLIUM-7, by Raymond Davis, Jr. [nd] 44p. (BNL-1118)

The nuclear recoil spectrum of the electron capture isotope Be^7 was measured from nearly monolayer deposits of the isotope on lithium fluoride and wolfram surfaces. The recoil spectrum was measured with an electrostatic analyzer having a two percent resolution. The spectra exhibited a peak at the high energy end of the spectrum consistent with the hypothesis of single neutrino emission in Be^7. From the maximum recoil ion energy observed of

55.9 ± 1.0 electron volts, an upper limit of 0.07 ± 0.05 electron masses was set for the mass of the neutrino. (auth)

2471
Wisconsin Univ.
ANGULAR DISTRIBUTION OF NEUTRONS SCATTERED BY HELIUM, by R. K. Adair. [nd] 33p. (AECU-1917)

A proportional counter filled with helium was irradiated with monoenergetic fast neutrons produced by bombarding thin lithium and tritium-filled zirconium targets with protons from the electrostatic generator. Angular distributions of the neutrons scattered by helium were determined by measuring the distribution in energy of the pulses from recoiling alpha particles with a differential discriminator. Measurements were made for eleven different neutron energies from 400 kev to 2730 kev. The angular distributions were consistent with a description of the neutron helium interaction in terms of an inverted $P_{3/2} - P_{1/2}$ doublet in He_5, split by about 5 Mev. (auth)

2472
ALIGNMENT OF COBALT-60 NUCLEI AT VERY LOW TEMPERATURES. C. J. Gorter, O. J. Poppema, M. J. Steenland, and J. A. Beun. Physica 17, 1050-1(1951) Nov.-Dec. (In English)

It has been suggested that anisotropic crystalline electric fields might cause nuclear alignment in crystals, and this effect might be preserved by antiferromagnetic interaction. A crystal of Co^{60}-labeled cobalt ammonium Tutton salt weighing 1.7 g and another crystal weighing 4.7 g in which about 95% of the Co ions were replaced by Zn ions were used to study these effects. The intensity of the γ-ray emission corresponded to about 300 and 90 μc. The crystals were embedded in pulverized Cr alum and demagnetized from values of H/T of about 21 kilogauss/degree. The intensity of the γ-ray emission was observed at different angles, applied fields, and temperatures. In the pure crystal an effect of the same order was found as in Fe^{59}. The intensity in the K I direction of the diluted crystal was about 12% lower than in the K II direction. In an applied field of about 300 gauss in the K I direction the effect was reduced to half its value. The rise of temperature due to the absorption of β rays reduced the effect to half its value in about 15 min.

2473
NUTATIONAL RESONANCE. H. C. Torrey. Phys. Rev. 85, 365-6(1952) Jan. 15.

A nuclear resonance absorption effect has been observed when both the off-time and on-time are short compared with the relaxation times T_1 and T_2. If a radiofrequency pulse contains an integral number of nutational periods it is possible for the signal to maintain a relatively large value as a result of a nutational resonance process. The solution to the Bloch equations for an infinite succession of r-f pulses is given for the special case of r-f resonance ($\omega = \gamma H_0$) and is shown to agree well with experimental nutational frequency resonance amplitudes for distilled water. For T_1 = 2.3 sec, T_2 = 1.4 sec, a value which indicates that the line width in distilled water is of the order of 10^{-4} gauss. The phenomenon of nutational resonance also explains the shape of signals obtained in an inhomogeneous magnetic field.

2474
ENERGY LEVELS IN C^{12} FROM $BE^9(\alpha,n)C^{12}$. W. H. Guier, H. W. Bertini, and J. H. Roberts. Phys. Rev. 85, 426-8 (1952) Feb. 1. (cf. NSA 4-5964)

A thin polonium source and thin beryllium target have been used to investigate energy states in C^{12}. The neutron spectrum was determined from proton tracks in Eastman NTA emulsions. By investigating the neutrons emitted in the forward and backward directions, neutrons associated with the transition to the ground state of C^{12} were detected, and excited levels in C^{12} were identified at 4.2 and 7.5 Mev above the ground state. (auth)

2475
MAGNETIC MOMENTS OF EVEN-ODD NUCLEI. Jack P. Davidson. Phys. Rev. 85, 432-4(1952) Feb. 1.

The deviations of nuclear magnetic moments from the Schmidt limits are interpreted in terms of a failure of L-S coupling, and a simple interpolation procedure is applied to compute the statistical weight of the components with L = I+½ and L = I−½. The results below odd N of Z = 53 are sufficiently regular to be used to compute the magnetic moments of several odd-neutron nuclei. (auth)

2476
THE SPIN AND QUADRUPOLE MOMENT OF O^{17}. S. Geschwind, G. R. Gunther-Mohr, and G. Silvey. Phys Rev. 85, 474-7(1952) Feb. 1.

Measurements of the quadrupole splitting caused by the O^{17} nuclear spin in the J = 1 → 2 transition of the $O^{17}C^{12}S^{32}$ pure rotational spectrum show that the spin of O^{17} is 5/2 and its quadrupole coupling constant is −2.32 ± 0.07 mc. From this coupling constant, the quadrupole moment of the O^{17} nucleus can be estimated as $Q = -5 \times 10^{-27}$ cm^2. O^{17} appears to fit the extreme single-particle model of the nucleus exceptionally well. (auth)

2477
SOME REGULARITIES IN NUCLEAR ENERGY LEVELS. P. J. Grant. Proc. Phys. Soc. (London) 65A, 150-1(1952)

On several occasions nuclear energy levels have been found whose excitation energies bear integral ratios to each other. A survey of experimental results showed that out of 45 nuclei where the positions of two or more energy levels are known accurately, 38 obeyed the integer rule to within 1 or 2%. The rule was also obeyed in a further 16 nuclei out of 23 where γ-ray energies were known but not the positions of the levels. If the highest common factor of the nuclear excitation energies is plotted against the nuclear charge Z, then it is found that the majority of the points lie on or near two smooth curves, one for even-even nuclei and the other for nuclei having either odd Z or odd N. This is especially striking in the case of even-even nuclei where, in addition, the nuclear shell structure appears to influence the shape of the curve, since there are peaks in the region of nuclei having N = 50 and N = 82. From this result it appears that the highest common factor of the excitation energies of the levels in a nucleus may have some physical significance as a nuclear constant.

2478
ON THE EFFECT OF THE NUCLEAR MAGNETIC MOMENT ON THE WIDTH OF LINES IN X-RAY SPECTRA. Marcel Frilley, Bhaskar G. Gokhale, and Manuel Valadares. Compt. rend. 233, 1183-5(1951) Nov. 12. (In French)

The hyperfine structure of the K_α lines of most elements can not be detected experimentally because the separation of the components is small compared with their natural width. However, for Nb and In the hyperfine separation is 10% of the width according to Breit's formula (Phys. Rev. 35, 1447(1930)), and should be detected either in asymmetry or broadening of the lines. The authors have measured the widths of the K_α lines of the elements from Rb to Sn to an accuracy of 0.005 X units and have found no difference in the appearance of the Nb and In lines. These results suggest that the effect of the nuclear magnetic moment is smaller than indicated by theory.

2479
NEUTRON TRANSMISSION CROSS SECTIONS IN THE KILOVOLT REGION. Carl T. Hibdon, Alexander Langsdorf, Jr., and Robert E. Holland. Phys. Rev. 85, 595-600(1952) Feb. 15.

Neutron transmission cross sections have been measured with about 2 kev resolution in the energy range from 2 kev to 25 kev, and to higher energies in some case. The neutrons, produced by the $Li^7(p,n)Be^7$ reaction with a Van de Graaff generator, were detected by a highly efficient (~ 15 percent) bank of boron trifluoride filled proportional counters placed to detect neutrons emitted at an angle of 120° from the proton beam direction. Measurements at the lower energies were made possible by a collimator and shield around the counters, which reduced background, and by the high efficiency obtained by many counters embedded in an array in a paraffin moderator. Resonances were observed in Na, Ti, V, Mn, Fe, Co, and Ni. (auth)

2480

THE NUCLEAR MAGNETIC MOMENT OF S^{33} FROM MICROWAVE SPECTROSCOPY. J. R. Eshbach, R. E. Hillger, and M. W. P. Strandberg. Phys. Rev. 85, 532-9 (1952) Feb. 15.

The magnetic dipole moment of the S^{33} nucleus was determined by means of the Zeeman effect on the hyperfine pattern of the $J = 1 \rightarrow 2$ rotational absorption of the molecule $O^{16}C^{12}S^{33}$ at about 24,020 Mc. The result is $\mu(S^{33}) = +0.633 \pm 0.010$ nuclear magneton. The sign of this moment was determined by using circularly polarized microwave radiation with σ-type Zeeman observations. The frequencies of all of the components of the hyperfine pattern were measured. They all fit the nuclear electric quadrupole coupling theory to within ± 0.01 Mc. The measured value for eqQ of the S^{33} nucleus in $O^{16}C^{12}S^{33}$ is $eqQ(O^{16}C^{12}S^{33}) = -29.07 \pm 0.01$ Mc. (auth)

NUCLEAR REACTORS

2481

WANTED: BETTER MATERIALS FOR NUCLEAR REACTORS. George E. Evans. Iron Age 169, No. 11, 93-7(1952) Mar. 13.

A brief review is given of the information contained in the papers presented at the Oak Ridge Summer Symposium on metallurgy. The properties a material must have to be used in the construction of a reactor or to be used as a reactor coolant are discussed.

2482

HOW TO LOAD A REACTOR. Nucleonics 10, No. 2, 24-5 (1952) Feb.

A brief description of the reactor at Oak Ridge National Laboratory is accompanied by pictures showing how the U slugs are loaded into it.

NUCLEAR TRANSFORMATION

2483

Radiation Lab., Univ. of Calif.

THE PHOTO-DISSOCIATION OF THE HELIUM NUCLEUS BY HIGH ENERGY GAMMA RAYS, by Seishi Kikuchi. Feb. 1, 1952. 5p. (UCRL-1665)

A He gas target has been irradiated with synchrotron γ rays having a maximum energy of 320 Mev. Photographic emulsions were exposed to the secondary particles emitted from the target, and the energy spectra of the protons emitted at 45, 90, and 135° were deduced by analysis of tracks in the emulsions. The proton-energy data are tabulated and compared with corresponding data reported previously (Bull. Am. Phys. Soc. 26, 5(1951)) on the photodissociation of the deuteron. Interpretation of the data in terms of γ absorption by a two-, three-, or four-nucleon system is considered briefly.

2484

Rochester Univ.

NEUTRON ENERGY DISTRIBUTION FROM Be, C, AND Pb BOMBARDED BY 245 MEV PROTONS, by B. K.Nelson, G. Guernsey, and G. Mott. Jan. 23, 1952. 39p. (NYO-3043)

The energy distribution of the neutrons radiated by targets bombarded by protons of energy 244 Mev has been measured. Neutrons in the forward direction from Be, C, and Pb targets were observed, and in a direction 15° from forward from Be and C targets. The neutrons were allowed to bombard a polyethylene radiator; scattered protons were observed by a scintillation counter coincidence telescope of four anthracene crystals. The effect of the carbon in the polyethylene was determined by taking similar data with a carbon radiator. The last counter in the telescope was used as a proportional counter, proton energies being determined by measuring the heights of the scintillation pulse in this crystal. A gated amplifier, turned on by a coincidence among the four crystals of the telescope, assured that only those pulses in the proportional counter corresponding to protons traversing the telescope from the radiator were counted. The entire neutron spectrum from about 120 to 240 Mev was measured at once by measuring the spectrum of pulses in the proportional crystal with a 24-channel pulse-height analyzer. All the spectra observed were found to be peaked, the energies at the peaks being about 215, 195, and 180 Mev for Be, C, and Pb, respectively, in the forward direction, and at about 175 and 165 for Be and C at 15°. The carbon and lead spectra were more broadly peaked than the beryllium spectra, and the 15° spectra were broader than the 0° spectra, the full widths at half maximum being 27%, 33% and 49% for Be, C, and Pb forward spectra, and 40% and 42% for Be and C at 15°. (auth)

2485

Catholic Univ. of America

FINAL REPORT ON NUCLEAR RESEARCH, by F. L. Talbott, A. Busala and G. C. Weiffenbach. July 1951. 15p. (NP-3597; Technical Report No. 2; U20705)

The angular distributions of protons from $Li^6(d,p)Li^7$ and $Li^6(d,p)Li^{7*}$ were measured at 780 and 1000 kev with the use of a pressurized generator. The photographic-emulsion technique was modified to permit investigation of angles near zero by evaporating the Li onto a thin target backing of Al. Other modifications included the use of several thicknesses of Al at various angles to permit both proton groups to end in the emulsion, and that of 50- and 100-μ-thick emulsions to allow greater foil adjustment. The track lengths of the protons in the emulsion were measured with a microscope, and histograms were compiled. The results are compared with those from previous investigations and indicate the need for a technique which permits a more definite separation of the 2 proton groups; this may be attained by using pure Li^6 or a magnetic velocity selector. With the selector the need for absorbers would be removed. Another investigation concerns the energy region below 0.5 Mev, in which the angular distribution of the α particles from the bombardment of Li^7 with protons will be studied. In order to obtain a stronger proton beam in the available generators, r-f ion sources will be employed. (cf. TIP U12385) (NRS abst.)

2486

ON THE SPECTRUM OF EVAPORATION NEUTRONS. Gerhart Lüders. Z. Naturforsch. 7a, 39-43(1952) Jan. (In German)

A simple relation exists between the energy spectrum of neutrons evaporated from an excited nucleus and the energy dependence of the inverse capture process. The cross section of this capture cross section can be calculated by means of a simple model. The method is applicable above neutron energies of 0.5 Mev; deviations appear at lower energies and are especially noticeable at low nuclear excitation energies.

2487

ENERGETIC PROTONS FROM NUCLEI EXPOSED TO 300-MEV BREMSSTRAHLUNG. James C. Keck. Phys. Rev. 85, 410-16(1952) Feb. 1

The protons ejected from various nuclei by the photon beam from the 300-Mev Cornell synchrotron have been studied with a scintillation counter telescope capable of distinguishing particles of different mass. The energy spectrum of protons from carbon and cadmium is roughly proportional to $1/E^2$ from 70 to 130 Mev and to $1/E^6$ from 130 to 240 Mev. The angular distribution of protons from carbon has a forward asymmetry which increased with proton energy. The yield per nucleus of 130-Mev protons from Be, C, Al, Cu, Cd, and Pb is proportional to Z. The excitation function for 105-Mev protons exhibits a steep rise in the neighborhood of a synchrotron energy of 200 Mev. The experimental results indicate the majority of the protons to be of photoelectric rather than mesonic origin. There is some evidence that the recoil particle involved in the production process carries off about half the primary photon energy, which suggests that it may be a neutron. (auth)

2488

THE DISINTEGRATION OF LITHIUM BY DEUTERON BOMBARDMENT. L. M. Baggett and S. J. Bame, Jr. Phys. Rev. 85, 434-6(1952) Feb. 1.

Thin-target excitation curves for the Li^7(d,n), Li^6(d,n), and Li^7(d,p) reactions are presented. The neutron data were taken at 90° to the deuteron beam using a BF$_3$-filled proportional counter in the long geometry. Resonances were observed in the Li^6(d,n) reaction at 0.41 and at 2.12 Mev, in the Li^7(d,n) reaction at 0.68, 0.98, and 2.1 Mev, and in the Li^7(d,p) reaction at 0.75, 1.00, and 1.4 Mev. These resonances correspond to excited states in Be^8 at 22.58 and 23.86 Mev and in Be^9 at 17.22, 17.45, 17.8, and 18.3 Mev. The cross section of the resonances observed in the Li^6(d,n) reactions were 9 and 41 millibarns/steradian, those for the Li^7(d,n) reaction were 39, 43, and 58 millibarns/steradian, and those for the Li^7(d,p) reaction were 0.230, 0.235, and 0.255 barn. (auth)

2489

ABSOLUTE EXCITATION FUNCTION OF THE Be^9(d,t) REACTION. Richard L. Wolfgang and W. F. Libby. Phys. Rev. 85, 437-40(1952) Feb. 1.

The gas-counting technique used earlier for the absolute assay of natural waters for tritium has been applied to the reactions producing tritium by the deuteron bombardment of beryllium. Absolute yield measurements for both thick and thin beryllium targets with deuteron energies ranging from 350 kev to 7.7 Mev have shown that the reaction cross section rises rapidly at about 1.5 Mev to a flat plateau at 0.23 ± 0.01 barn, extending up to 7.7 Mev. From these results the tritium production appears to be about as prolific as the neutron production. In general one feels that the large magnitude of the (d,t) cross section must be associated with the low binding energy of the extra neutron in Be^9. (auth)

2490

NUCLEAR DISINTEGRATION BY POSITRON-K ELECTRON ANNIHILATION. R. D. Present and S. C. Chen. Phys. Rev. 85, 447-54(1952) Feb. 1.

A new process for the annihilation of fast positrons is discussed, in which a positron with insufficient energy to excite or disintegrate a nucleus by collision, annihilates a K electron of an atom with subsequent excitation or disintegration of its nucleus. If the positron energy is close to threshold for the process, competition from two-quanta annihilation does not occur. The process is of first order and, apart from the occurrence of negative energy states, is the reverse of internal conversion. The cross section can be factored into a cross section for annihilation with emission of a photon converging on the nucleus times a probability for nuclear disintegration. In the electric dipole case, the latter is just the ratio of the photodisintegration cross section to the P-wave blackbody absorption cross section of the nucleus. The photodisintegration cross section is taken from experiments. The annihilation cross section in light elements has been calculated in the Born approximation using the complete retarded interaction corresponding to converging spherical waves of electric dipole radiation (the nucleus acts as a sink for these waves, in addition to conserving momentum). For large incident energy of the positron ($\gg mc^2$) the difference between positive and negative energy states can be neglected approximately, and the cross section obtained by detailed balancing from the internal-conversion coefficient.

Numerical estimates have been made for the disintegration of Be^9 with emission of a neutron and also for the disintegration of U^{238} resulting in nuclear fission. The total annihilation-disintegration cross sections near the threshold in these two cases are $\sim 10^{-34}$ cm^2 and $\sim 10^{-31}$ cm^2, respectively. The total cross section for an annihilation-excitation of In^{115} into an activation level for the metastable state, resulting in the formation of a nuclear isomer, is found to be $\sim 10^{-26}$ cm^2. (auth)

2491

(γ,n) REACTIONS. Armand Lataste. J. phys. radium 13, 39-45(1952) Jan. (In French)

The author reviews the principal observations on (γ,n) reactions and discusses threshold energies, reaction cross sections, resonance cross sections (including the theory of Goldhaber and Teller), multiple photodisintegration by high-energy γ rays, affinity of the (γ,n) and (n,2n) reactions, and use of the (γ,n) reaction as a source of neutrons.

2492

INVESTIGATION OF THE COLLISION CROSS SECTION OF LITHIUM FOR NEUTRONS. P. Verzaux. J. phys. radium 13, 21-7(1952) Jan. (In French)

In this theoretical study, it is shown that for thermal and slow neutrons the high collision cross section of Li is due to the Li^6 isotope, as is known from experiment. For fast neutrons, the scattering resonance at 270 kev is due principally to Li^7, whereas the reaction resonance at the same neutron energy is due to Li^6. Application of these concepts to the production of tritons or tritium is discussed.

2493

EXPERIMENTAL STUDY BY THE PHOTOGRAPHIC METHOD OF THE SCATTERING OF HIGH-ENERGY NUCLEONS BY NUCLEI. P. Cüer and J. Combe. J. phys. radium 13, 77S-78S(1952) Jan. (In French)

Nuclear emulsions were exposed to 90- and 270-Mev neutrons and to 340-Mev protons in the Berkeley synchrocyclotron. Observations on the differences in charge changes and angular distributions between the reactions of light (C, N, O) and heavy (Ag, Br) nuclei are discussed. The results are explained in terms of an instantaneous substructure in the light nuclei (Cüer, Phys. Rev. 80, 906(1950)).

2494

THE ENERGY SPECTRUM OF THE PROTONS PRODUCED IN THE REACTION C^{12}(d,p)C^{13} IN RELATION TO THE POSSIBLE EXCITED STATES OF C^{13}. J. Catalá de Alemany and F. Senent Perez. Anales real soc. españ. fís. y quím. 47, Ser. A, 225-30(1951) Sept.-Oct. (In Spanish)

Acetylene targets were bombarded with 7.86-Mev deuterons from the Liverpool cyclotron. Tracks in C2 emulsions of the protons produced in the reaction C^{12}(d,p)C^{13} were examined. Histograms of the number of protons emitted as a function of their range at various angles from 25 to 135° indicate clearly that the residual C^{13} nucleus has energy levels of 3.88 ± 0.08 and 3.091 ± 0.08 Mev. No tracks corresponding to an energy level in C^{13} at 0.8 Mev were found.

2495

NEUTRON YIELD FROM THE NUCLEAR PHOTOEFFECT. J. S. Levinger and H. A. Bethe. Phys. Rev. 85, 577-81 (1952) Feb. 15.

The yields of neutrons produced in photonuclear reactions by a bremsstrahlung-proton spectrum are analyzed in terms of the multiplicity of neutron production. Approximating the neutron multiplicity as proportional to the photon energy, we derive the integrated photonuclear cross section from the experimental neutron yields. The integrated cross section from copper to bismuth is $\int_0^\infty \sigma dW = 0.14NZ/A$. (Uranium has a neutron yield 35 percent higher than given by this relation, probably due to photofission.) This relation has the correct form, but a somewhat higher absolute value than the theoretical relation $\int_0^\infty \sigma dW = 0.060(NZ/A)(1 + 0.8x)$, where x is the fraction of exchange force. (auth)

2496

THE REACTION $Be^9(p,\alpha\gamma)Li^6$. R. B. Day and R. L. Walker. Phys. Rev. 85, 582-5(1952) Feb. 15.

The energy of the gamma radiation produced when Be^9 is bombarded by 2.6-Mev protons has been measured with a scintillation spectrometer and found to be 3.58 ± 0.04 Mev. A suggestion of Hushley that this gamma ray is produced in the reaction $Be^9(p,\alpha\gamma)Li^6$ was verified by observing coincidences between the gamma rays and low energy alpha particles. The excited state of Li^6 which emits the gamma rays probably has spin zero and even parity and is presumably the analog of the ground state of the isobaric nucleus, He^6. The thick-target yield and cross section at resonance were found to be 4.8×10^{-6} gamma rays per proton and 0.11×10^{-24} cm^2, respectively. (auth)

2497

THE (p,n) REACTION ON SEPARATED ISOTOPES OF CHROMIUM. J. A. Lovington, J. J. G. McCue, and W. M. Preston. Phys. Rev. 85, 585-9(1952) Feb. 15.

Several hundred resonances have been observed in the neutron yield from proton bombardment of the enriched isotopes Cr^{53} and Cr^{54}. No characteristic groups of resonances are observed. Upper limits to the level spacing in the compound nuclei Mn^{54} and Mn^{55} are 4 and 5 kev, respectively. The thresholds are found to be 1406 ± 8 kev for Cr^{53}(p,n) and 2202 ± 5 kev for Cr^{54}(p,n). (auth)

PARTICLE ACCELERATORS

2498

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF DECEMBER 13, 1951, by Sergey Shewchuck. Feb. 11, 1952. 6p. (UCRL-1656)

Radiation from Electrons in the Synchrotron, by D. L. Judd. Schwinger's conclusions (Phys. Rev. 75, 1912(1949)) regarding light emitted by radiation from electrons in a magnetic field are briefly summarized, and Parzen's correction factor (Phys. Rev. 84, 235(1951)) is discussed. Errors in Parzen's results are pointed out (cf. UCRL-1599; NSA 6-918). For the Berkeley synchrotron about 70 quanta are emitted per turn, so that the line breadth is about 70 times the separation of the discrete line spectrum calculated by Schwinger for an electron forced to follow an exactly periodic orbit. Thus the actual spectrum is continuous. Photodisintegration of the Deuteron, by Seishi Kikuchi. For an abstract of the paper on which this talk was based, see UCRL-1552 (NSA 6-703). Detection of Azimuthal Polarization in n-p Scattering, by L. F. Wouters. See UCRL-1470 (NSA 6-386) and UCRL-1508 (NSA 6-715).

2499

Radiation Lab., Univ. of Calif.

INDEX TO INFORMATION AVAILABLE ON THE 60-INCH CROCKER CYCLOTRON. Jan. 7, 1952. 10p. (UCRL-1651)

2500

A COIL SYSTEM FOR AN AIR-CORED BETATRON. R. Latham, M. J. Pentz, and M. Blackman. Proc. Phys. Soc. (London) 65B, 89-93(1952) Feb.

The design of an air-cored coil system for a small betatron is described. The apparatus produces a sufficiently homogeneous field to permit operation at 50 cps and low gas pressures in the doughnut. Modification of the design is suggested to reduce the out-of-phase fields and the phase variations of the pulsed field. If such modification were made, operation at higher gas pressures would be possible.

2501

SIMULATION OF TRAJECTORIES OF CHARGED PARTICLES IN MAGNETIC FIELDS. George H. Vineyard. J. Applied Phys. 23, 35-9 (1952) Jan.

A ball rolling on a rotating surface is shown to simulate the motion of a charged particle in a magnetic field. The theory is given for the case of a warped surface undergoing arbitrary rotation about a fixed axis and translation perpendicular thereto, while the system from which the ball is observed partakes of similar but independent motion. With approximations based on not too large departure of the surface from flatness, the following cases can be simulated: (a) The magnetic field is homogeneous and constant. The electric field is perpendicular to the magnetic field, and irrotational, but otherwise arbitrarily spatially dependent, and arbitrarily time dependent within certain limits. (b) The magnetic field is homogeneous but arbitrarily time dependent. The electric field is perpendicular to the magnetic field and may have a variety of space and time dependences, including a part which encircles the axis and has just the right magnitude to produce acceleration in a circular orbit as in the betatron.

Results of rudimentary experiments are presented which indicate that the method is capable of good accuracy. (auth)

2502

PARTICLE DYNAMICS IN THE LINEAR ACCELERATOR. J. R. Terrall and J. C. Slater. J. Applied Phys. 23, 66-8 (1952) Jan.

Hamilton's equations for the motion of an electron in a linear accelerator are integrated to find the final kinetic energy and phase of an electron injected with arbitrary initial kinetic energy and phase, after traveling down a fixed length of accelerator. The results are expressed in the form of a map of the initial energy-phase space onto a final energy-phase space. This map proves in practice to be very convenient for discussing the actual operation of the accelerator. The curves presented are calculated for numerical values appropriate for the M.I.T. accelerator. (auth)

RADIATION ABSORPTION AND SCATTERING

2503

Atomic Energy Project (Canada)

THE SCATTERING OF NEUTRONS BY BOUND PROTONS AND CRYSTALS, by H. H. Clayton. Summer 1947. 71p. (LT-21; NRC-2393)

2504

Oak Ridge National Lab.

STOPPING OF FISSION FRAGMENTS IN GASES, by E. C. Campbell, W. M. Good, and W. A. Strauser. [nd] 15p. (AECU-1891)

An abstract of this report was indexed as AECD-2341 and appeared in Nuclear Science Abstracts as NSA 1-1632.

2505

Rochester Univ.

DIFFERENTIAL N-P SCATTERING CROSS-SECTION FOR

220 MEV NEUTRONS, by G. Guernsey, G. Mott, and B. K. Nelson. Jan. 23, 1952. 21p. (NYO-3044)

The differential neutron-proton scattering cross section as a function of angle has been investigated for neutron energies of 220 and 180 Mev. A ½-in. Be target at the 58-¼-in. radius in the University of Rochester 130-in. cyclotron was used to produce a beam of neutrons. This neutron beam scattered protons from a polyethylene scatterer which were detected by a four scintillation counter coincidence telescope. A measurement of the pulse height from the last counter was used to determine the energy of the scattered proton. The effect of the carbon in the polyethylene was subtracted by taking runs with a carbon scatterer calculated to have the same number of carbon atoms per cm^2 as had the polyethylene. Runs were taken from 0 to 50° for the proton angle in the laboratory coordinate system. A comparison is made of the 220-Mev angular distribution with the Berkeley 260-Mev data which indicates essential agreement of the shapes. (auth)

2506

Radiation Lab., Univ. of Calif.

THE ELASTIC SCATTERING OF PROTONS FROM HELIUM 4, by Bruce Cork. Feb. 11, 1952. 10p. (UCRL-1673)

The absolute differential cross section has been measured for 31.6-Mev protons scattered elastically from helium. Seven increments of angles from 15 to 51° in the laboratory system of coordinates have been measured simultaneously using proportional counters. The observed nuclear scattering is approximately three times the calculated Rutherford scattering for a scattering angle of 17° in the center of mass system and approximately 100 times the calculated Rutherford scattering for an angle of 62° in the center of mass system. Also, the differential cross section for a center of mass angle of 55° has been observed to be 59.1 millibarns/steradian for incident protons of 19.5 Mev in the laboratory system. (auth)

2507

MEASUREMENT OF GAS DENSITY BY CORPUSCULAR-RADIATION DEVICES. E. Schopper and B. Schumacher. Z. Naturforsch. 6a, 700-5(1951) Nov. (In German)

Absorption of a particle beam can be applied to measurement of nonstationary states of highly rarefied gases in which schlieren and interference methods fail. The theory and fundamental problems in applying beams of ions, protons, and electrons are discussed.

2508

THE SCATTERING OF NEUTRONS AND OF PROTONS BY DEUTERONS. R. A. Buckingham, S. J. Hubbard, and H. S. W. Massey. Proc. Roy. Soc. (London) 211A, 183-203(1952) Feb. 21.

The theoretical treatment of neutron-deuteron collisions is extended to include neutrons with energy up to 16 Mev, and also collisions between deuterons and protons with incident energy up to 11.5 Mev. Previous results are also modified by the inclusion of effects arising from a relative angular momentum $\sqrt{6}\hbar$ (d scattering). A detailed comparison is made with experimental evidence for the total elastic cross section for n-d collisions, and for the angular distribution of protons and neutrons scattered by deuterons. Within the accuracy of measurement the evidence is consistent with charge independence of the nuclear forces at the energies concerned; the comparison with calculated results appears strongly to favor forces of the symmetrical exchange type (or some similar exchange type) as against ordinary forces. Iterative methods of solving numerically the integro-differential equations arising in this kind of problem are discussed in an appendix. (auth)

2509

MOMENTUM IN THE ANNIHILATION OF SLOW POSITRONS IN VARIOUS SOLID MATERIALS. H. Maier-Leibnitz. Z. Naturforsch. 6a, 663-7(1951) Nov. (In German)

From coincidence frequency measurements on annihilation quanta in a fixed geometry, the mean square of the center-of-mass momentum of positron + electron in the moment of annihilation was calculated. Measurements were made with Al, Cu, Ag, Sn, Ta, W, Au, Pb, and Bi. Large differences were noted from element to element, permitting some qualitative conclusions on the nature of the external electron shells in the metal lattice.

2510

INVESTIGATION CONCERNING THE ENERGY OF BACK-SCATTERING OF ELECTRONS. Francis Suzor and Georges Charpak. J. phys. radium 13, 1-10(1952) Jan. (In French)

Two semicylindrical G-M counters were used to study the back-scattering through a 2π solid angle of the β radiations from S^{35}, Co^{60}, RaE (Bi^{210}), and P^{32} deposited on Al. The results are plotted as a function of energy and thickness of the Al. The experiments also were carried out with the conversion electrons emitted by Tc^{99*} and In^{155*}. The hypothesis of difference between β particles and electrons was not supported by the results of this study.

2511

THE DEPENDENCE OF PARAMAGNETIC NEUTRON SCATTERING ON COUPLING BETWEEN Mn^{++} IONS. Philip J. Bendt. Ph.D. Thesis, Columbia University, 1951.

The various effects influencing neutron scattering in the situation where neighboring ion spins are neither completely free nor rigidly locked were investigated. Results are listed for samples of MnF_2 and MnO. In the interpretation of these results three effects are prominent: (1) a fraction of the final transition states, which would be available in the case of free ions, are energetically forbidden, because the neutron does not have enough energy to excite them; (2) the ionic form factor is more important in reducing inelastic scattering than in reducing elastic scattering (in the absence of coherence effects); (3) there is coherent scattering due to short range ordering of the ion spins.

2512

ON THE THEORY OF MULTIPLE SCATTERING OF CHARGED PARTICLES. F. Sauter and H. Wanke. Z. Naturforsch. 7a, 33-9(1952) Jan. (In German)

Rigorous transformation of the multiple-scattering integral equation into a differential equation has led to an approximation process for determination of the angular dependence of the scattering intensity. The method gives in the first approximation a solution function from which a well-known value of the mean square of the scattering angle is obtained. Numerically, this agrees in order of magnitude with the expression derived from Molière's theory (Z. Naturforsch 2a, 133(1947); 3a, 78(1948)) if the scattering intensity formula is cut off at the first term of the Gauss function. This latter method is highly arbitrary, whereas the present process for mean-square calculation is completely rigorous.

2513

MULTIPLE SCATTERING OF NUCLEAR PARTICLES IN PHOTOGRAPHIC EMULSION. Ellen Hisdal. Fysik. Verden 13, 206-23(1951). (In Norwegian)

The experimental methods and theory of measuring multiple scattering of electrons, protons, mesons, etc., in nuclear emulsions are discussed briefly. 15 references.

2514

ON THE RADIATIVE CORRECTION TO THE COULOMB SCATTERING OF ELECTRONS. L. R. B. Elton and H. H. Robertson. Proc. Phys. Soc. (London) 65A, 145-6(1952) Feb.

The results obtained by Schwinger (Phys. Rev. 76, 790 (1949)) for the radiative correction to electron scattering by nuclei was checked by the use of the method of Feynman (Phys. Rev. 76, 769(1949)), and agreement with Schwinger's formula was obtained.

2515

FURTHER CALCULATIONS OF X-RAY DIFFUSION IN AN INFINITE MEDIUM. L. V. Spencer and Fannie Stinson. Phys. Rev. 85, 662-4(1952) Feb. 15.

The problem of x-ray diffusion in an infinite homogeneous medium can be solved numerically by a method of expansion into suitable polynomial systems. This method has already been applied to determine the spectrum of scattered radiation as a function of distance from the radiation source for several cases of interest. This note presents further numerical applications of the polynomial method. (auth)

2516

GEOMETRICAL OPTICS AND THE THEORY OF MULTIPLE SMALL ANGLE SCATTERING. George H. Vineyard. Phys. Rev. 85, 633-6(1952) Feb. 15.

The theory of the small-angle scattering of x rays or thermal neutrons by particles of matter, in the case of particles large enough to produce large phase shifts, is re-examined. A theory based entirely on geometrical optics has been frequently employed in the past, and it is pointed out that, in the case of a single particle, this treatment gives an incomplete account of the scattering. A Huygen's-principle approximational method (which is known to duplicate the results of wave theory in the single-particle case), is applied to the many-particle case, and it is shown that, here, the theory based entirely on geometrical optics is justified. (auth)

2517

MULTIPLE SCATTERING OF WAVES. II. THE EFFECTIVE FIELD IN DENSE SYSTEMS. Melvin Lax. Phys. Rev. 85, 621-9(1952) Feb. 15.

The multiple scattering of waves interacting with a system of particles is treated by a self-consistent approach. Scattering processes are described by operators that permit anisotropy, absorption, and creation. The scattering system may be randomly, partially, or completely ordered. The propagation constant k′ of the coherent wave in the scatterer medium differs from the vacuum constant k by $(k')^2 = k^2 + 4\pi ncf(k', k')$, where n is the scatterer density and f is an operator whose matrix elements f(b,a) represent the scattering amplitude in direction b for a wave incident in direction a on a single scatterer bound by the forces of its neighbors. The parameter c, defined by $cf(k', k') = \int \exp(-ik' \cdot r) f \times \psi_e(r) dr$, is a measure of the ratio of the effective field $\psi_e(r)$ to the average field. An integral equation is found for $\psi_e(r)$ with the help of a "quasi-crystalline" approximation. A variational expression is then found for c that becomes exact for point scatterers. A comparison is made of finite and infinite scattering systems. The extinction theorem is proven. The macroscopic viewpoint is found to be applicable to small systems whose size is large compared to the scatterer potential range, and the range of scatterer position correlations. (auth)

2518

NEUTRON SCATTERING LENGTHS. D. C. Peaslee. Phys. Rev. 85, 555-8(1952) Feb. 15.

The schematic treatment of nuclear reactions is applied to the case $E_n \to 0$ as a means of interpreting measurements of the scattering length a. It is found that the quantity $\Delta = (a - R)$ rather than a is significant for determining the resonance properties of the compound nucleus, where R is the phenomenological nuclear radius. In some cases this treatment can resolve ambiguity in the evaluation of a without the necessity of polarization measurements and assign the J value of a low-lying resonance or two, but it can only be used successfully for separated isotopes. For practically pure isotopes it can be used to determine rough values of level spacing D from the measured position of the levels nearest $E_n = 0$, or conversely. Values of D obtained in this way are plotted against A to yield an estimate of a parameter in the statistical formula for level density; this estimate suggests a somewhat more rapid increase in level spacing with decreasing excitation than given by the simplest statistical formula. (auth)

2519

MESON TAIL EFFECT AND TREATMENT OF PROTON-PROTON SCATTERING DATA. M. C. Yovits, R. L. Smith, Jr., M. H. Hull, Jr., J. Bengston, and G. Breit. Phys. Rev. 85, 540-54(1952) Feb. 15.

The fit of experimental material on proton-proton scattering by phenomenological potentials is reviewed with the inclusion of observations by Heydenburg-Little in the 300-kev region and of Cork at 30 Mev. Weighting of data by a criterion based on internal consistency is employed. Data obtained by means of Van de Graaff machines are used to determine the best fits for different shapes of potential energy curves. Other data are compared with the resultant (f,E) plots graphically. A trend towards agreement with the long-tailed Yukawa and exponential well potentials is noticeable among the supposedly more accurate measurements of Rouvina and of Cork. The meson potential $-Ce^{-r/a}/(r/a)$ with $C = (93.4 \pm 1.0)mc^2$, $a = (0.412 \pm 0.002)e^2/mc^2$ fits experiment and corresponds to a meson mass of 333 ± 2m, the limits of error being stated somewhat arbitrarily. The effect of the tail of the Yukawa potential on scattering is studied with particular attention to its influence on the nearly linear functions of energy used in the analysis of experiment, and on the coefficients of powers of the energy in the expansion of this function (f). The convergence of the power series is better if the tail of the potential is chopped off. Calculation of coefficients in this series is also easier for the potential without tail. The more practical arrangements of calculations are: (a) direct calculation of f for a number of energies, the tail effect being treated by a first-order approximation; and (b) calculation of coefficients of powers of E in the series for f for potential without tail followed by first-order calculation of effect of tail on f. Results obtained in these ways are compared. (auth)

RADIATION EFFECTS

2520

THE EFFECT OF NEUTRON IRRADIATION ON METALLIC DIFFUSION. T. H. Blewitt and R. R. Coltman. Phys. Rev. 85, 384(1952) Jan. 15.

A sample of Cu_3Au was disordered, sealed in vacuum, and the electrical resistance measured at 200°C where the relaxation time is of the order of 10^5 hr. The sample was then placed in an ORNL graphite reactor at a location where the fast-neutron flux was of the order of 1×10^{12} neutrons/cm^2/sec, with the temperature being maintained at 200°C. The electrical resistance was subsequently measured as a function of time, and the results are presented in the form of graphs. A lag of 12 hr was observed when the pile was shut down, indicating that the relaxation time for ordering had decreased to ~12 hr at 200°C. Since saturation appears to occur in one month, 10^6 atoms, or regions ~100 A in diameter, should be affected, indicating that defects have a small but appreciable mean free path before annihilation.

2521

ON THE FLUORESCENCE OF GASES EXCITED BY α PARTICLES. A. E. Grün and E. Schopper. Z. Naturforsch. 6a, 698-700(1951) Nov. (In German)

The fluorescent light excited in gases by individual α particles was studied with a secondary-electron multiplier. Among the "technically pure" gases, N_2 and A had about 100 times the quantum yield of H_2, O_2, or CO_2. Addition of organic vapors caused extinction. The quantum yield in N_2 was estimated to be 1000 quanta in the spectral region 3000 to 4000 A per α particle of 4-cm range at normal pressure.

RADIOACTIVITY

2522

Brookhaven National Lab.

LOW ENERGY γ-TRANSITIONS IN SOME RARE EARTH ISOTOPES, by J. W. Mihelich and E. L. Church. Dec. 14, 1951. 5p. (BNL-1092)

Internal conversion spectra of the γ transitions following the β decay of Nd^{147}, Dy^{165}, Ho^{166}, Tm^{170} and Lu^{176m} were examined. The energy and intensity data are tabulated as well as published lifetimes and empirical K/L ratios. Intensities are normalized to the most intense L line of each spectrum. It is apparent that these spectra arise from different types of nuclear transitions. The transitions following the decay of Nd^{147} and Dy^{165} occur in odd-even nuclei. They have comparatively high K/L ratios and one predominant L conversion line. Lifetime and K/L ratio considerations predict the multipolarity of both transitions to be M1 or (M1 + E2) mixtures. The transitions following the decay of Ho^{166}, Tm^{170}, and Lu^{176m} occur in even-even nuclei, and should therefore, as a rule, be of E2 multipole order. This is in agreement with the lifetimes and the low K/L ratios (~0.15). Here, the L conversion lines consist of intense L_{II} and L_{III} groups and a weak L_I group. It is interesting to note that, to within ±0.2 kev, the energies of the three E2 transitions vary linearly with atomic number.

2523

Brookhaven National Lab.

THE EMISSION OF L X-RAYS OF LEAD IN Po^{210} DECAY, by William Rubinson and William Bernstein. [nd] 25p. (BNL-1071)

By use of a proportional counter x-ray spectrometer it is established that Po^{210} sources emit characteristic L photons of Pb, in yield 2.93×10^{-4} (±15%) per alpha particle. The excitation of these photons is ascribed to the ejection of L electrons from the electronic cortege of the nucleus in the act of alpha decay, in a manner treated by Migdal's theory. The probability of L electron ejection is about 8.8×10^{-4} per alpha particle, as computed from the observed photon yield and Kinsey's fluorescence yields. The theory in its present state accounts for only 13% of the photons observed. (auth)

2524

Brookhaven National Lab.

A RE-INVESTIGATION OF THE DOUBLE BETA DECAY FROM Sn^{124}, by E. L. Fireman and D. Schwarzer. [nd] 14p. (BNL-1098)

Radiations from natural Sn and Sn enriched with the 124 isotope have been examined in a magnetic field with a He-filled cloud chamber triggered by internal counters. Only 5 pictures out of more than 4000 showed two electrons coming out of the same point in the Sn and entering the counters, and even these may be pictures of multiply scattered electrons passing through the Sn. A lower limit of 10^{17} yr is set for the half life of double-β decay of Sn^{124}. This indicates a decay rate less than one-tenth that previously reported by Fireman (Phys. Rev. 74, 1238(1948); 75, 323(1949); NSA 2-1137). Six cloud-chamber photographs are included in the report.

2525

Radiation Lab., Univ. of Calif.

NICKEL 56, by W. J. Worthington, Jr. Feb. 6, 1952. 4p. (UCRL-1671)

The formation is reported of Ni^{56} by cyclotron bombardment of Zn target foils, followed by chemical purification obtained by adding inactive Co to the isolated Ni fraction and separating the Ni and Co through the use of an anion exchange column. Larger quantities of Ni^{56} were produced from bambardment of elemental Fe with He ions through the reaction $Fe^{54}(\alpha,2n)Ni^{56}$. Using a scintillation detector connected to a pulse analyzer, the half life of Ni^{56} was determined to be 6.0 ± 0.5 days, with at least four γ rays with energies of approximately 0.16, 0.5, 0.8 and > 1.4 Mev, with decay mainly by electron capture.

2526

Knolls Atomic Power Lab.

ISOTOPIC ABUNDANCES OF TITANIUM AND NICKEL, by H. C. Mattraw and C. F. Pachucki. [nd] 2p. (AECU-1903)

The principal method used for the determination of isotopic abundances is the mass spectrometer. Gases such as Xe or Kr are easily handled by commercially available instruments but the determination of the metal isotopes usually require extensive modification. However, since many metals can be converted to volatile compounds we decided to use nickel carbonyl and titanium tetrachloride as typical volatile metal compounds to determine the performance of the General Electric Mass Spectrometer. The instrument was not modified in any way to accomodate these compounds. The isotopic abundances of Ni and Ti determined in this experiment are listed in Tables 1 and 2 and are compared with the results of other workers.

Table 1

Per cent Abundances of Nickel Isotopes

Mass No.	58	60	61	62	64
This experiment	68.0	26.3	1.13	3.66	1.01
White, Cameron[1]	67.76	26.16	1.25	3.66	1.16
Inghram, Hess[2]	67.92	26.22	1.16	3.71	0.98
Ewald[3]	69.18	25.82	0.97	3.28	0.75

[1] Phys. Rev. 74, 991(1948)

[2] ANL-4120 (1948)

[3] Z. Physik 122, 686(1948)

Table 2

Per cent Abundances of Titanium Isotopes

Mass No.	46	47	48	49	50
This experiment	7.87	7.25	73.9	5.56	5.43
Nier[4]	7.95	7.75	73.45	5.51	5.34
Hibbs[5]	8.22	7.42	73.88	5.56	5.41

[4] Phys. Rev. 53, 282(1938)

[5] Y-508 (1949)

The isotopic abundances were determined from Ti^+ and Ni^+ ion abundances. The Ni^+ abundances had to be corrected for a small amount of $Ni(CO)_2^{++}$ ions. Since the most abundant doubly charged ion, $Ni^{58}(C^{12}O^{16})_2^{++}$ is at mass 57, the contributions of the less abundant ions, e.g., $Ni^{60}(C^{12}O^{16})_2^{++}$ at mass 58, to the nickel peaks could be accurately calculated and the actual nickel abundances accurately determined. The peak heights in the mass region, 46 to 50, of the Ti^+ ions were not complicated by doubly charged ions falling in the same region. (Entire report)

2527

Carnegie Inst. of Tech.

FINE STRUCTURE AND ANGULAR CORRELATION IN Po^{210}, by S. De Benedetti and G. H. Minton. Dec. 13, 1951. 7p. (NYO-3296)

A coincidence method has been employed to detect a low energy component in the α spectrum of Po^{210}. The results of a study of the angular correlation between the directions of emission of these α particles and succeeding γ rays indicate that the angular momentum of the α particles is 2 and that the γ radiation is electric quadruple. (auth)

2528

Carnegie Inst. of Tech.

ON POSSIBLE NATURAL RADIOACTIVITY OF NEODYMIUM, by George I. Mulholland and Truman P. Kohman. Nov. 1, 1951. 6p. (NYO-713)

A search has been made for natural radioactivity of neodymium, using ion exchange and radiochemical purification techniques and a large internal-sample low-background proportional counter. At most 1 count per minute of soft or hard radiation was observed from 1650 cm^2 of Nd$_2$O$_3$, whereas from the results of Libby (1934) about 270 cpm would be expected. The maximum specific beta activity is 0.003 disintegrations per second per gram of element, corresponding to a minimum half life of 2×10^{15} years for Nd^{150}. Reasons are given for supposing Nd^{150} to be unstable but with a very long half life. The maximum specific alpha activity is 0.02 disintegrations per second per gram of neodymium. (auth)

2529

Brookhaven National Lab.

THE DETERMINATION OF GAMMA-RAY ENERGIES FROM BETA-RAY SPECTROSCOPY AND A TABLE OF CRITICAL X-RAY ABSORPTION ENERGIES, by R. D. Hill, E. L. Church, and J. W. Mihelich. Jan. 24, 1952. 13p. (BNL-1115)

In the use of β spectrometers to determine the energies of nuclear transitions from energies of conversion-electron lines, it is necessary to know the energies required to remove electrons from the various shells and sub-shells of the converting atoms. The significance and limitations of the use of x-ray absorption energies in these determinations of γ energies are discussed. A complete table of critical x-ray absorption energies, based primarily on the work of Siegbahn and derived using the 1950 values of the physical atomic constants, is given, with interpolations and extrapolations, for elements between Z = 3 and Z = 100.

2530

Carnegie Inst. of Tech.

SEARCH FOR NATURAL RADIOACTIVITY OF CALCIUM^{48}, by John W. Jones and Truman P. Kohman. Jan. 1, 1952. 6p. (NYO-714)

Recently published mass measurements of Ca^{48} and Ti^{48} indicate that Ca^{48} is unstable against beta-decay to 44-hour Sc^{48} by 1 Mev or more. A search for this transition has been made by the active daughter extraction method. No Sc^{48} activity could be detected in 9 kilograms of calcium, indicating a minimum half life of 2×10^{16} years for the transition. Log ft must be at least 24.8; this is discussed. (auth)

2531

THE RADIOACTIVITY OF POTASSIUM 40. C. F. G. Delaney. Sci. Proc. Roy. Dublin Soc. 25, 251-94(1951) Nov. 12.

An end window G-M counter has been used in an investigation of the decay of K^{40}. The counter geometry was determined by measuring the apparent β emission from standard sources of Ra(E + F) whose absolute activity had been deduced by α-particle counting with nuclear plates. The K sources were prepared by distributing crystalline KCl uniformly over a flat circular Ni container. The specific activity of ordinary K was found to be 31.9 ± 3 β/sec. The disintegration constant and half life for β decay of K^{40} are 5.5×10^{-10}/yr and 1.25×10^{9}/yr respectively, the probable error in each case being ~10%. The thickness of Al required to reduce the intensity of β rays by half was found to be 69.5 ± 2 mg/cm^2. The maximum β energy was then calculated as 1.65 ± 0.2 Mev. The paper concludes with a critical survey of the results of other workers and of various proposed decay schemes for K^{40}.

2532

RADIATIONS FROM RADIOACTIVE RHODIUM (105). C. E. Mandeville and E. Shapiro. J. Franklin Inst. 253, 145-51(1952) Feb.

The characteristic radiations of the 36-hr Rh^{105} have been investigated with the use of conventional absorption and coincidence methods. The β rays were found to have a maximum energy of 0.55 Mev, and the γ rays a quantum energy of ~0.3 Mev. The β-γ coincidence rate of Rh^{105} indicated that less than 8% of the β rays are coupled with the γ ray.

2533

FURTHER WORK ON HEAVY COLLATERAL RADIOACTIVE CHAINS. W. W. Meinke, A. Ghiorso, and G. T. Seaborg. Phys. Rev. 85, 429-31(1952) Feb. 1 (cf. 5-2954)

The half life of Ac^{222} has been determined as 5.5 ± 0.5 sec, and an upper limit of 5 sec has been set for the half life of Pa^{225}. An additional short-lived chain collateral to the actinium (4n + 3) natural radioactive family has also been partially identified. This chain decays as follows: $U^{227} \rightarrow Th^{223} \rightarrow Ra^{219} \rightarrow Em^{215} \rightarrow Po^{211} \rightarrow Pb^{207}$. (auth)

2534

THE HALF LIFE OF RaE. F. Begemann and F. G. Houtermans. Z. Naturforsch. 7a, 143-4(1952) Jan. (In German)

The half life of RaE (Bi^{210}) was determined to be 5.02 ± 0.02 days by following its decay with an end-window counter.

2535

AN INVESTIGATION OF THE DOUBLE BETA-DECAY OF $_{50}$Sn^{124}. Marvin I. Kalkstein and W. F. Libby. Phys. Rev. 85, 368-9(1952) Jan. 15.

The double-β activity of Sn^{124} has been investigated by means of two screen-wall counters in coincidence within the same cylinder. The Sn sample containing 95 ± 1% Sn^{124} was mounted on one half of a slide, and a sample of ordinary Sn which had received identical preparation was mounted on the other half. Alternate counting of the background and sample was accomplished by tipping the cylinder so that the sample slide could move from one end to the other within a fixed slide through the center of the cylinder between the counters. The minimum half life for the double-β decay was calculated as between 1.7 and 2.4×10^{17} yr, depending on the energy assumed (1.0 to 2.0 Mev). An investigation was also made of the possibility of two successive β emissions through the intermediate nucleus Sn^{124}; the minimum half life for this transition is 10^{17} yr.

2536

THE RADIOACTIVE DECAY OF Hg^{197} and Hg^{203}. J. M. Cork, D. W. Martin, J. M. LeBlanc, and C. E. Branyan. Phys. Rev. 85, 386-7(1952) Jan. 15.

The decay schemes of Hg^{197} and Hg^{203}, produced in the Argonne heavy-water reactor, have been investigated spectrometrically. The conversion electrons of the strong 134.3- and 165.4-kev γ rays satisfy the work functions characteristic of Hg and are associated with isomeric transitions in Hg before K capture. The 25-hr Hg^{197} isomer decays by emission of the 134.3-kev γ, which is followed in 10^{-8} sec by the 165.4-kev γ transition to the 66.4-hr ground state. The ground state then decays by β^+ emission or K capture to either the 269- or 77.6-kev level of Au^{197}. Hg^{203} was found to decay with a half life of 47.9 ± 0.2 days; a single γ, of energy 279.5 kev, was observed.

2537

L-ELECTRON CAPTURE AND ALPHA-DECAY IN Np^{235}. Ralph A. James, Albert Ghiorso, and Donald Orth. Phys. Rev. 85, 369-70(1952) Jan. 15.

The radiations of Np^{235} have been found to consist of K and L x rays accompanying electron capture, and α particles having an energy of 5.06 ± 0.02 Mev. The disintegration energy available for the reaction $Np^{235} + e^- \rightarrow U^{235}$ is calculated by the closed-cycle system as 0.26 Mev. After subtracting the orbital-electron binding energies, 0.14 Mev and 0.24 Mev are the energies available for K-electron capture and L-electron capture, respectively. By using Xe-filled proportional counters connected to a 48-channel pulse analyzer it was concluded that the branching ratio for Np^{235} is as follows; α emission, 0.005%; K capture $<10\%$; and L capture $>90\%$. Most of the L x rays apparently arise from vacancies in the L_{II} and L_{III} levels. The total half life is 410 ± 10 days.

2538

INVESTIGATION OF COINCIDENCE IMPULSES GIVEN IN A 4π COUNTER BY THE RADIOELEMENT P^{32}. Francis Suzor and Georges Charpak. Compt. rend. 234, 720-2(1952) Feb. 11. (In French)

Coincidences were found between two semicylindrical G-M counters located on either side of an Al sheet on which was deposited P^{32}. Absorbers of Al or aluminized polyvinyl could be placed over the source. A soft component was found which could be attributed neither to ionization x rays nor bremsstrahlung nor with much probability to nuclear electron emission. The effects would be explained by nuclear emission of a 10-kev photon in 10 to 20% of the P^{32} disintegrations.

2539

ON THE SPONTANEOUS EMISSION OF NEUTRONS BY URANIUM. Maurice Élie Nahmias. Compt. rend. 233, 1185-7(1951) Nov. 12. (In French)

A suggestion was made by Da Silveira (Portugaliae Phys. 1, 167(1945)) that neutrons emitted by natural U might be due to a neutron decay of UX_2 (Pa^{234m}). A careful repetition of her experiments, using 3 kg of U_3O_8 and a BF_3 counter, has shown the emitted neutrons to be those of U^{235} spontaneous fission.

SPECTROSCOPY

2540

Kansas State Coll.

FOCUSING IN A BETA-RAY SPECTROMETER WITH TILTED SOURCES, by C. M. Fowler and P. Domotor. [nd] 8p. (AECU-1922)

Formulas are given which express the theoretical line shape obtained in a semicircular beta-ray spectrometer. The sources are taken to be plane, uniform, and isotropic. Line shapes of a monoenergetic electron group are studied as a function of the angle between source and focal planes. The treatment given applies only to the electrons emerging perpendicular to the magnetic field. However, conditions simulating the requirements for qualitative applicability of the formulas may be obtained practically by slitting out electrons having appreciable momentum components along the field. Two figures are given which illustrate line shapes for various spectrometer geometries. (auth)

2541

ENERGY LEVELS AND WAVELENGTHS OF THE ISOTOPES OF MERCURY-198 AND -202. Keivin Burns and Kenneth B. Adams. J. Optical Soc. Am. 42, 56-9(1952) Jan.

In the region 6709 to 2302 A the wavelengths of sixty lines in the first spectra of the even isotopes of mercury, Hg^{198} and Hg^{202}, have been measured relative to 5460.7532 A. Electrodeless tubes containing 0.5 mg of mercury were excited by radio waves of 90- to 300-Mc frequency. A comparison of the wavelength and level systems of the two isotopes confirms the opinion that the spectrum of natural mercury may be useful as a source of secondary standards, since the isotope shift of the odd level $6p\,{}^1P_1{}^\circ$ is nearly the same as that of several even levels.

2542

HYPERFINE STRUCTURE AND ISOTOPE SHIFT IN THE SPECTRUM OF TELLURIUM. John S. Ross and Kiyoshi Murakawa. Phys. Rev. 85, 559-63(1952) Feb. 15.

Using separated isotopes of tellurium, the hyperfine structure of the Te I and Te II spectra was studied. The magnetic moments of the two odd isotopes were calculated to be $\mu(Te^{125}) = -0.6 \pm 0.2$ nm, $\mu(Te^{123}) = -0.5 \pm 0.2$ nm. The ratio of the magnetic moments was determined to be $\mu^{125}/\mu^{123} = 1.186 \pm 0.007$. Anomalous shift of the even isotopes was detected in the lines $\lambda 4006$ ($5s5p^4\,{}^4P_{5/2} - 5p^2({}^3P_0)6p_{3/2}p$) and $\lambda 4049$ ($5s5p^4\,{}^4P_{3/2} - [5p^2({}^3P_1)6p]_{3/2}$). The spacings between consecutive even isotopes in the line $\lambda 4006$ were as follows: $\Delta(130-128) = 0.014$, $\Delta(128-126) = 0.011$, $\Delta(126-124) = 0.026$, $\Delta(124-122) = 0.017$, $\Delta(122-120) = 0.017\ cm^{-1}$, the component due to the heaviest isotope lying on the largest frequency side. The centers of gravity of the odd isotopes in the line $\lambda 4006$ were: $\Delta(124-125) = 0.002$, $\Delta(123-122) = 0.000\ cm^{-1}$. $\lambda 4049$ showed nearly the same isotope effect as $\lambda 4006$. (auth)

THEORETICAL PHYSICS

2543

THE TWO-BODY SCATTERING PROBLEM WITH NON-CENTRAL FORCES. I. NON-RELATIVISTIC. G. J. Kynch. Proc. Phys. Soc. (London) 65A, 83-93(1952) Feb.

A perturbation theory is developed for the two-body problem so that central and non-central forces can be treated in a consistent manner. A phase matrix S(r) is introduced which satisfies a first-order Riccati equation. The asymptotic value of S occurs in the formula for the cross section, and for a special choice of functions is the Heisenberg matrix of the problem. The formalism leads to a simple comparison of neutron-proton and proton-proton scattering, an analysis of the degree of separation of the simultaneous equations which occur, and of the most suitable choice of S(r) for calculation. (auth)

2544

THE TWO-BODY SCATTERING PROBLEM WITH NON-CENTRAL FORCES. II. RELATIVISTIC. G. J. Kynch. Proc. Phys. Soc. (London) 65A, 94-101(1952) Feb.

It has been shown that both for one particle scattered by a centre of force and in the two-body problem, treated relativistically, equations for the S matrix of the Riccati type can be found exactly similar to and as simple in form as those of the non-relativistic approximation. The analytic continuation of this matrix, to determine bound states, has the same limitations as in the non-relativistic problem. (auth)

2545

SINGULAR SOLUTIONS OF THE KLEIN-GORDON EQUATION CONSIDERING AN EXTERNAL ELECTRIC FIELD. M. Demeur. Physica 17, 933-7(1951) Nov.-Dec. (In French)

The singular solutions relative to particles of 0 and ½ spin placed in a uniform and constant electric field are given without approximation. Integral representations are given for Δ, Δ_F, S, and S_F. (auth)

2546
APPLICATIONS OF PARITY CONSERVATION IN QUANTUM MECHANICS. I. DISINTEGRATION INTO TWO OR THREE BOSONS OF NON-ZERO MASS. Louis Michel. Compt. rend. 234, 703-5(1952) Feb. 11. (In French)

Rigorous selection rules for boson interactions are demonstrated. If S, V, A, and P designate scalar, vector, pseudovector, and pseudoscalar bosons, respectively, spontaneous disintegration of a boson into distinct bosons of non-zero mass is forbidden for each of the cases SSP, PPP, SPV, SSA, PPA, SSSP, and SPPP where it is not necessary to specify which is the initial particle.

2547
RENORMALIZATION OF SCALAR ELECTRODYNAMICS USING β-FORMALISM. Abdus Salam. Proc. Roy. Soc. (London) 211A, 276-84(1952) Feb. 21.

This paper indicates, in terms of the β-formalism, the general procedure for renormalizing the S-matrix in the theory of charged spin-zero particles interacting with the electromagnetic field. Special identities holding only for the 5-rowed representation of β-matrices are employed to show (i) that the number of primitive divergent integrals is finite, and (ii) that it is possible to arrange an identical cancellation of all but two types of divergences. These last are removed by renormalizations. The mechanism of the proof shows what would be needed if vector electrodynamics is ever to have its divergences absorbed by renormalization techniques. (auth)

2548
SPIN-SPIN RELAXATION IN A SIMPLE SYSTEM. Julian Eisenstein. Phys. Rev. 85, 603-6(1952) Feb. 15.

A system of two particles of spin ½ coupled by their dipolar interaction and in an arbitrary magnetic field is considered. It is shown that exact expressions for the energy levels of the system can be obtained. The density matrix is calculated exactly for the cases where a magnetic field is suddenly applied, parallel or perpendicular, to the line joining the dipoles. It is used in the evaluation of the magnetic moment of the system. Instead of there being a gradual approach to an equilibrium situation the magnetic moment varies harmonically in time. A partially successful attempt is made to calculate the density matrix when the functional dependence of the magnetic field on the time is more complicated than a step function. The exact calculations for this simple system are compared with the approximate calculations of Waller for a system of N spins. It is pointed out that there may be no gradual approach to equilibrium in the N-spin system, either. (auth)

2549
DIVERGENCE OF PERTURBATION THEORY IN QUANTUM ELECTRODYNAMICS. F. J. Dyson. Phys. Rev. 85, 631-2 (1952) Feb. 15.

An argument is presented which leads tentatively to the conclusion that all the power-series expansions currently in use in quantum electrodynamics are divergent after the renormalization of mass and charge. The divergence in no way restricts the accuracy of practical calculations that can be made with the theory, but raises important questions of principle concerning the nature of the physical concepts upon which the theory is built. (auth)

2550
POINT TRANSFORMATIONS IN QUANTUM MECHANICS. Bryce Seligman DeWitt. Phys. Rev. 85, 653-61(1952) Feb. 15.

An isomorphism is shown to exist between the group of point transformations in classical mechanics and a certain subgroup of the group of all unitary transformations in quantum mechanics. This isomorphism is used to indicate that the quantum analogs of physically significant classical expressions can be constructed uniquely in any coordinate system. There is no ambiguity in the ordering of noncommuting quantum operators, and the method of constructing the quantum analogs is covariant under general coordinate transformations. The method is actually only applicable to systems having lagrangians which are at most quadratic in the velocities, but this includes all systems which are presently of interest in physics. The method is applied to two intrinsically nonlinear examples, one of which is the gravitational field. The correct hamiltonian operator for a quantized version of Einstein's gravitational theory is constructed. (auth)

2551
ON THE STATISTICAL DISTRIBUTION OF PARTICLE MOVEMENTS IN QUANTUM MECHANICS. André Regniér, Evry Schatzman, and Jean-Pierre Vigier. Compt. rend. 234, 410-12(1952) Jan. 21. (In French)

Introduction of a real quantum field (pilot wave) into wave mechanics and simple considerations on the equipartition of energy between the field and the particles it pilots leads to the Schoedinger statistical distribution for the mean state. (auth)

AUTHOR INDEX

For each reference the digit preceding the dash is the volume number and digits after the dash are the abstract number.

ABSON W
6-2437
ADAIR R K
6-2471
ADAMS KENNETH B
6-2541
AHMANN DONALD H
6-2336
ALLEN AUGUSTINE O
6-2329
AMERICAN ELECTRO METAL
CORP
6-2300
AMERIO ALESSANDRO
6-2396
AMES LAB
6-2301 6-2308 6-2464
AMIS EDWARD S
6-2311
ANDERSON L C
6-2356
ANDERSON NORMAN G
6-2245
ARGONNE NATIONAL LAB
6-2320 6-2324 6-2346
6-2411 6-2420 6-2430
6-2431 6-2432 6-2433
6-2434 6-2466
ARKANSAS UNIV
6-2311
ATOMIC ENERGY PROJECT
CANADA
6-2503
ATOMIC ENERGY PROJECT
UNIV OF CALIF
LOS ANGELES
6-2269
ATOMIC ENERGY PROJECT
UNIV OF ROCHESTER
6-2279
ATOMIC ENERGY RESEARCH
ESTABLISHMENT HARWELL
BERKS ENGLAND
6-2309 6-2314 6-2367

BAGGETT L M
6-2488
BAKER T W
6-2314
BAME S J JR
6-2488
BARKLEY LLOYD B
6-2348
BARNETT GUY F
6-2435
BATTELLE MEMORIAL INST
6-2374 6-2378
BEGEMANN F
6-2534
BENDICH AARON
6-2280
BENDT PHILIP J
6-2511
BENGSTON J
6-2519
BENNETT A E
6-2326
BERNARD WALTER J
6-2295
BERNAS RENE
6-2419
BERNSTEIN HAROLD
6-2383
BERNSTEIN RICHARD B
6-2320
BERNSTEIN WILLIAM
6-2523
BERSTEIN IRVING A
6-2444
BERTINI H W
6-2474
BEST GEORGE
6-2436
BETHE H A
6-2495
BEUN J A
6-2472
BIRD R BYRON
6-2318 6-2319
BLACKMAN M
6-2500
BLEWITT T H
6-2520
BLOCK M M
6-2458
BOARTS R M
6-2386
BOATMAN JOSEPH B
6-2276
BOLTON ELLIS T
6-2349
BONETTI A
6-2452
BONILLA CHARLES F
6-2361 6-2362 6-2363
6-2364
BOTHE W
6-2397
BOWERS JOHN Z
6-2292
BOYD G E
6-2327
BRANYAN C E
6-2536
BRAUER GEORG
6-2335
BRAUER PETER
6-2333 6-2338 6-2441
BREIL GUNTHER
6-2307
BREIT G
6-2519
BRODSKY MERWYN B
6-2377
BROOKHAVEN NATIONAL LAB
6-2247 6-2255 6-2284
6-2285 6-2286 6-2289
6-2290 6-2294 6-2297
6-2329 6-2347 6-2357
6-2360 6-2368 6-2390
6-2391 6-2470 6-2522
6-2523 6-2524 6-2529
BROWN WILLIAM E
6-2343
BROWNELL GORDON L
6-2439
BROWNELL L E
6-2356
BUBB FRANK W
6-2424
BUCK WARREN L
6-2430
BUCKINGHAM R A
6-2508
BUCKLES ROBERT E
6-2302
BURG ANTON B
6-2317
BURNS KEIVIN
6-2541
BUSALA A
6-2485

CAHN R W
6-2314
CALIFORNIA UNIV
BERKELEY
6-2298 6-2310
CALIFORNIA UNIV
LOS ANGELES
6-2414
CAMPBELL E C
6-2504
CAMPBELL I G
6-2353
CANCER RESEARCH INST
NEW ENGLAND DEACONESS
HOSPITAL BOSTON
6-2252
CARNEGIE INST OF TECH
6-2527 6-2528 6-2530
CASE J M
6-2358
CATHOLIC UNIV OF
AMERICA
6-2485
CHAIKOFF I L
6-2257
CHAMOVITZ DAVID L
6-2278
CHARPAK GEORGES
6-2510 6-2538
CHEN S C
6-2490
CHURCH E L
6-2522 6-2529
CLASS C M
6-2469
CLAYTON H H
6-2503
CLOW AVIS
6-2321
COBBLE J W
6-2327
COCKCROFT JOHN
6-2244
COGAN DAVID G
6-2271
COLLINS J P
6-2363
COLTERYAHN L E
6-2376
COLTMAN R R
6-2520
COLUMBIA UNIV
6-2294 6-2361 6-2362
6-2363 6-2364
COMAR C L
6-2291
COMBE J
6-2493
CONNICK ROBERT E
6-2351
COOK HAROLD D
6-2308
CORK BRUCE
6-2506
CORK J M
6-2536
CORRSIN STANLEY
6-2365
COWIE DEAN B
6-2349
CRITCHFIELD C L
6-2399
CRUSSARD CHARLES
6-2380
CUBICCIOTTI DANIEL
6-2304 6-2334 6-2377
CUER P
6-2493

DAANE ADRIAN H
6-2336
DARDEN EDGAR B JR
6-2249 6-2250 6-2427
DAUNT J G
6-2387 6-2418
DAVIDSON JACK P
6-2475
DAVIS RAYMOND JR
6-2470
DAY R B
6-2496
DE ALEMANY J CATALA
6-2494
DE BENEDETTI S
6-2527
DELAHAY PAUL
6-2299 6-2341
DELANEY C F G
6-2531
DEMEUR M
6-2545
DETHMERS PIET
6-2264
DE TROYER A
6-2413
DEUTSCHMANN MARTIN
6-2406
DEVIK FINN
6-2267
DEW R E
6-2358
DEWITT BRYCE SELIGMAN
6-2550

DICKERSON R F
6-2374
DIXON FRANK J
6-2251
DODSON R W
6-2294
DOMOTOR P
6-2540
DONALDSON DAVID D
6-2271
DORFMAN L M
6-2352
DOW CHEMICAL CO
6-2379
DUKE UNIV
6-2345
DYSON F J
6-2549

EASTWOOD W S
6-2274
EHMERT A
6-2398 6-2407
EISENSTEIN JULIAN
6-2548
ELTON L R B
6-2514
EMORY UNIV
6-2283
ENGINEERING RESEARCH
INST MICH UNIV
6-2356
ENGLISH JAMES A
6-2254
ENTENMAN CECIL
6-2246
EPSTEIN LEO F
6-2385
ERICSON ROBERT P
6-2336
ESHBACH J R
6-2480
EVANS GEORGE E
6-2481

FARIS F E
6-2325
FARMER EARLE C
6-2444
FASSEL VELMER A
6-2308
FASSELL W MARTIN JR
6-2373
FERMI ENRICO
6-2463
FIREMAN E L
6-2524
FISCHER VERA K
6-2450
FONGER W
6-2408 6-2409
FOSSATI FRANCO
6-2446
FOTI STEPHEN
6-2313
FOWLER C M
6-2540
FRED MARK
6-2346
FREEDBERG A STONE
6-2278
FREEDMAN M
6-2433
FREY E
6-2266
FRILLEY MARCEL
6-2478
FRITZ-NIGGLI HEDI
6-2265 6-2266

GAMMILL ADRIAN M
6-2342
GANZ DIETER
6-2403
GARRISON WARREN M
6-2328
GASTEL R
6-2286
GAULDEN MARY ESTHER
6-2249 6-2250
GAUS HEINRICH
6-2461
GELINAS R W
6-2469
GESCHWIND S
6-2476
GHIORSO ALBERT
6-2533 6-2537
GIBADLO FRANK
6-2384
GIBBS MARTIN
6-2286 6-2290
GILBERT W
6-2448

GINELL WILLIAM S
6-2368
GLEASON G I
6-2275
GLOCKLER GEORGE
6-2337
GLUZBARG W
6-2331
GOEDDEL W V
6-2375
GOKHALE BHASKAR G
6-2478
GOLDBERG NEWTON N
6-2348
GOLDBERG R C
6-2257
GOLDSMITH SAMUEL A
6-2253
GOLDIE HORACE
6-2277
GOLDTHWAIT DAVID A
6-2280
GOMBERG H H
6-2356
GOOD W M
6-2504
GOODMAN LEONARD S
6-2466
GORDY WALTER
6-2345
GORTER C J
6-2472
GRANT P J
6-2477
GREEN L JR
6-2325
GROSSE ARISTID V
6-2323
GRUN A E
6-2521
GUERNSEY GORDON L
6-2467 6-2484 6-2505
GUIER W H
6-2474
GUNTHER-MOHR G R
6-2476

HAAG HEINZ
6 2335
HACH CLIFFORD C
6-2336
HAENDLER HELMUT M
6-2295 6-2296 6-2321
HAHN PAUL F
6-2277
HAISSINSKY MOISE
6-2331
HAMELIN J
6-2395
HANFORD WORKS
6-2268
HANNA S S
6-2469
HANSARD SAM L
6-2291
HARLEY JOHN H
6-2313
HARVARD UNIV MEDICAL
SCHOOL
6-2289
HASTINGS A BAIRD
6-2289
HATCH L P
6-2360
HAUPTSCHEIN MURRAY
6-2323
HAVENS W W JR
6-2458
HAYCOCK E W
6-2298
HAYDEN RICHARD J
6-2420
HAYNER J H
6-2369
HAZEN W E
6-2400
HECKMANN IRMGARD
6-2306
HEER C V
6-2387
HEISENBERG W
6-2454
HELLER ROBERT E
6-2416
HEMPELMANN LOUIS H
6-2273
HENNIG G
6-2324
HIBDON CARL T
6-2479
HILDEBRAND JOEL H
6-2298 6-2310
HILL R D
6-2529

HILLGER R E
6-2480
HISDAL ELLEN
6-2513
HOCKER K H
6-2405
HOFFMAN JOSEPH G
6-2273
HOLLAND ROBERT E
6-2479
HOLT MARGARET W
6-2252
HOUGEN J O
6-2340
HOUTERMANS F G
6-2534
HOWATSON JOHN
6-2342
HUBBARD S J
6-2508
HUFF PRENTISS BAKER
6-2283
HULL M H JR
6-2519
HUND F
6-2354
HUNT ERNEST L
6-2283
HURSH JOHN B
6-2258 6-2281
HURST W M
6-2429
HURWITZ LEON
6-2282

IANDELLI A
6-2339
ILLINOIS INST OF TECH
6-2320 6-2377
INSTITUTE FOR THE STUDY
OF RATE PROCESSES
UNIV OF UTAH
6-2373
IOWA STATE UNIV
6-2302
ISAKOFF SHELDON
6-2360
ISAKSON G
6-2425
ITTNER WILLIAM B III
6-2438
IVANENKO D
6-2456

JACKSON JASPER
6-2436
JAMES RALPH A
6-2537
JAOUL BERNARD
6-2380
JASTROW R
6-2448
JOHNS HOPKINS UNIV
6-2469
JOHNSON EVERETT R
6-2329
JOHNSON R D
6-2375
JONES HARDIN B
6-2288
JONES JOHN W
6-2530
JONES L
6-2415
JOSEPH W
6-2376
JUDD D L
6-2498
JURGENSEN H
6-2443

KALKSTEIN MARVIN
6-2535
KAMEFUCHI SUSUMU
6-2459
KANSAS STATE COLL
6-2540
KATZ JOSEPH J
6-2320
KECK JAMES C
6-2487
KEHRES PAUL W
6-2308
KELLER WAYNE H
6-2336
KELLY LOLA S
6-2288
KENNEDY W R
6-2414
KIEFFER R
6-2316
KIKUCHI SEISHI
6-2483 6-2498

KNOLLS ATOMIC POWER LAB
6-2352 6-2355 6-2385
6-2526
KOHMAN TRUMAN P
6-2528 6-2530
KOMATSU KOZO
6-2388
KONNERTH ANDREW
6-2276
KOUTE HERBERT J
6-2390
KROTZ LAIRD C
6-2308
KRUMHOLZ LOUIS A
6-2248
KURLAND GEORGE S
6-2278
KYNCH G J
6-2543 6-2544

LABORATORY FOR NUCLEAR
SCIENCE AND
ENGINEERING
MASS INST OF TECH
6-2410
LAMSON BALDWIN G
6-2256
LANGSDORF ALEXANDER JR
6-2479
LANZL LAWRENCE HERMAN
6-2462
LARSEN EDWIN M
6-2342
LASLETT L JACKSON
6-2464
LATASTE ARMAND
6-2491
LATHAM R
6-2500
LAWRENCE JOHN H
6-2263
LAX MELVIN
6-2517
LEBEDEV V
6-2456
LEBLANC J M
6-2536
LEFORT MARC
6-2332
LEITNER R G
6-2275
LEVINE ROBERT
6-2348
LEVINGER J S
6-2495
LIBBY W F
6-2489 6-2535
LISCO HERMANN
6-2273
LOCKHART HELEN S
6-2439
LOEMKER KATHERINE
6-2250
LOS ALAMOS SCIENTIFIC LAB
6-2436
LOUISIANA STATE UNIV
6-2299 6-2341
LOVINGTON J A
6-2497
LUDERS GERHART
6-2486
LYTLE W J
6-2372

MACARA R
6-2309
MCCUE J J G
6-2497
MCGRATH THOMAS F
6-2348
MCKEWAN WILLIAM
6-2373
MACMULLEN JEAN
6-2289
MCVEY W H
6-2351
MAIER-LEIBNITZ H
6-2509
MALLETT M W
6-2378
MANDEVILLE C E
6-2532
MARTIN A B
6-2375
MARTIN D W
6-2536
MARTIN J J
6-2356
MASSACHUSETTS INST OF
TECH
6-2253 6-2425
MASSEY H S W
6-2508
MATTRAW H C
6-2352 6-2526
MAURER PAUL H
6-2251
MAZZA L
6-2339
MEINKE W W
6-2356 6-2533
MESSIAH A M L
6-2449 6-2465
MEYER L
6-2324
MEZZETTI L
6-2426
MICHEL LOUIS
6-2546
MIGNONE G
6-2445
MIHELICH J W
6-2522 6-252[illegible]
MIKAELSEN KNUT
6-2255
MILLER WILLIAM T
6-2248
MILNER G W C
6-2309
MINNESOTA MINING AND
MANUFACTURING CO
6-2322
MINTON G H
6-2527
MOENICH J S
6-2431 6-2432
MOH C C
6-2262
MOHNEY JOHN B
6-2258
MORPHEW ALAN T
6-2359
MORRISON ADAIR
6-2366
MORRISON R B
6-2356
MOSES CAMPBELL
6-2276
MOTT GEORGE R
6-2467 6-2484 6-2505
MOUSSA A
6-2447
MUELLER DONALD W
6-2436
MUHLEISEN R
6-2417
MULHOLLAND GEORGE I
6-2528
MURAKAWA KIYOSHI
6-2542
MURRAY RAYMOND L
6-2423

NAGAMIYA TAKEO
6-2388
NAHMIAS MAURICE ELIE
6-2539
NATIONAL BUREAU OF
STANDARDS
6-2435
NATIONAL RESEARCH
COUNCIL OF CANADA
6-2366
NAVAL MEDICAL RESEARCH
INST BETHESDA
6-2254 6-2256
NAVAL RADIOLOGICAL
DEFENSE LAB
6-2246
NELSON BRUCE K
6-2467 6-2484 6-2505
NELSON H R
6-2378
NEW HAMPSHIRE UNIV
6-2295 6-2296 6-2321
NEWKIRK LESTER L
6-2464
NEY E P
6-2399
NICOTERA ERNEST T
6-2383
NIX MARJORIE
6-2249
NODIFF EDWARD A
6-2323
NONAKA ITARU
6-2422
NORTH AMERICAN AVIATION
INC
6-2375
NOWOTNY H
6-2316
NUCLEAR PHYSICS LAB
COLUMBIA UNIV
6-2468

OAK RIDGE NATIONAL LAB
6-2245 6-2249 6-2250
6-2283 6-2327 6-2427
6-2429 6-2504
OEHME REINHARD
6-2455
OHIO STATE UNIV
6-2387
OLEKSA SOPHIE
6-2399
OMEARA JOHN P
6-2330
OPATOWSKI I
6-2260 6-2261
ORTH DONALD
6-2537
OSUCH CARL
6-2348

PACHUCKI C F
6-2352 6-2526
PALAZZO D F
6-2364
PAPP C A
6-2378
PARRAVANO GIUSEPPE
6-2305
PASSMAN S
6-2458
PATTERSON WILLIAM JR
6-2295
PAYNE ANITA H
6-2288
PAYNE P R
6-2353
PEARLSON W H
6-2322
PEASLEE D C
6-2518
PEETZ U
6-2354
PENNSYLVANIA STATE COLL
6-2376
PENTZ M J
6-2500
PEREZ F SENENT
6-2494
PERFETTI BRUNO M
6-2348
PITTSBURGH UNIV
6-2251 6-2348
PITZER E C
6-2355
PLAZIN JOHN
6-2284
PLOCH WERNER
6-2421
POND VIRGINIA
6-2247
POPOV ALEXANDER
6-2302 6-2337
POPPEMA O J
6-2472
POST R F
6-2428
POWELL CARL
6-2277
POWERS MARION D
6-2385
PRESENT R D
6-2490
PRESTON W M
6-2497
PREUSS LUTHER E
6-2440
PROCTOR BERNARD E
6-2253

QUERZOLI R
6-2426

RABALD ERICH
6-2371
RADIATION LAB
UNIV OF CALIF
6-2288 6-2328 6-2415
6-2416 6-2428 6-2448
6-2450 6-2483 6-2498
6-2499 6-2506 6-2525
RANKIN B
6-2448
RATHGEBER H D
6-2393
RAY W E
6-2376
READ H J
6-2376
READ JOHN
6-2259 6-2412
REESE ALGERNON [illegible]
6-2271
REFF ISRAEL
6-2457
REGNIER ANDRE
6-2551
RENSSELAER POLYTECHNIC IN
6-2340

ESEARCH FOUNDATION OHIO STATE UNIV 6-2418
IEKE R R 6-2372
IEMAN WILLIAM III 6-2343
IETVELD A O 6-2413
OBERTS J H 6-2474
OBERTSON H H 6-2514
OBINSON DEAN W 6-2296
OCHESTER UNIV 6-2449 6-2465 6-2467 6-2484 6-2505
OLLEFSON G K 6-2328
OSAHN PAUL D 6-2263
OSE J W 6-2415
OSS JOHN S 6-2542
OSSLE F 6-2405
OTARIU G L 6-2298
OTHSTEIN ASER 6-2282
UBINSON WILLIAM 6-2523
UDDY JOHN M 6-2357
USS CLEM 6-2276
USSELL O J 6-2370

ACKS J 6-2285
ALAM ABDUS 6-2547
ALIN R 6-2447
ANCIER KENNETH M 6-2297 6-2347
ANDS MARGOT K 6-2349
ANGSTER RAYMOND C 6-2410
AUBERLICH H E 6-2291
AUTER F 6-2512
CHAFER HARALD 6-2307
CHATZMAN EVRY 6-2551
CHEIN MARCEL 6-2392 6-2404
CHINZ H R 6-2266
CHLUTER ARNULF 6-2389 6-2394
CHMITZ-DUMONT O 6-2306
CHOPPER E 6-2405 6-2507 6-2521
CHULZ A 6-2450
CHUMACHER B 6-2507
CHWARZER D 6-2524
COTT KENNETH G 6-2292
EABORG G T 6-2533
EEGER ALFRED 6-2442
ERRES A 6-2382
ETTI R LEVI 6-2451
HACTER BERNARD 6-2246
HAPIRO E 6-2532
HATFORD P A 6-2367
HEPPARD C W 6-2427
HEWCHUCK SERGEY 6-2448 6-2450 6-2498
HORT H G 6-2312
HULL HARRISON 6-2301
HUTT R P 6-2391
IDDALL J W 6-2425
SILVERMAN JOSEPH 6-2294
SILVEY G 6-2476
SIMON GEORGE P 6-2368
SIMPSON J A 6-2409
SINEX F MAROTT 6-2285 6-2289
SINGLETARY JOHN 6-2436
SITTKUS A 6-2403 6-2407
SKIPPER HOWARD E 6-2272
SLATER J C 6-2502
SLOAN-KETTERING INST FOR CANCER RESEARCH 6-2280
SMALLER BERNARD 6-2434
SMITH C A 6-2325
SMITH LUTHER 6-2262
SMITH R L JR 6-2519
SOMMERS SHELDON C 6-2252
SPARROW ARNOLD H 6-2247
SPARROW RHODA C 6-2247
SPEDDING FRANK H 6-2336
SPENCER L V 6-2515
SPIKES JOHN D 6-2303
STANFORD UNIV 6-2428
STEELE ROBERT 6-2284
STEENLAND M J 6-2472
STIEHL GEORGE L 6-2341
STINSON FANNIE 6-2515
STOLZ G JR 6-2363
STRANDBERG M W P 6-2480
STRAUSER W A 6-2504
STREIT GEORGE H 6-2414
STROMQUIST W K 6-2386
SUNDER JOSEPH H 6-2276
SUZOR FRANCIS 6-2510 6-2538
SWANK ROBERT K 6-2430 6-2431 6-2432

TABERN D L 6-2275
TAKAHASHI YASUSHI 6-2459
TALBOTT F L 6-2485
TALMAGE DAVID W 6-2251
TANGHERLINI F R 6-2260
TAPLIN GEORGE V 6-2269
TAVORA ELYSIARIO 6-2315
TAYLOR D 6-2437
TECHNICAL INFORMATION SERVICE AEC 6-2359
TENNESSEE UNIV 6-2287 6-2386
TENNESSEE VALLEY AUTHORITY 6-2248
TER-POGOSSIAN MICHEL 6-2438
TERRA LUIGI 6-2446
TERRALL J R 6-2502
TEUCHER M 6-2401 6-2453
THIRRING WALTER E 6-2460
THOMASSEN L 6-2356
THURN H 6-2397
TOBIAS CORNELIUS A 6-2263
TOMASINI G 6-2451 6-2452
TORREY H C 6-2473
TREIMAN S B 6-2408
TSENG T P 6-2387
TULLIS JOHN L 6-2254 6-2256
TWOMBLY GRAY H 6-2293

UMEZAWA HIROOMI 6-2459
URELES ALVIN L 6-2278

VALADARES MANUEL 6-2478
VAN ITTERBEEK A 6-2413
VAN KRANENDONK J 6-2318 6-2319
VAN SLYKE DONALD D 6-2284
VAN VALKENBURG PRISCILLA A 6-2258
VAN WYLEN G J 6-2356
VERZAUX P 6-2492
VIDALE M L 6-2404
VIGIER JEAN PIERRE 6-2551
VINCENT E T 6-2356
VINEYARD GEORGE H 6-2501 6-2516
VON SALLMANN LUDWIG 6-2270

WACHTELL R L 6-2300
WALKER R L 6-2496
WANG JUI HSIN 6-2350
WANKE H 6-2512
WARREN SHIELDS 6-2252
WATKINS F B 6-2277
WATSON E C 6-2268
WEIFFENBACH G C 6-2485
WEISS H M 6-2443
WERNET JOSEF 6-2344
WHEELER CHARLES M JR 6-2296
WHITE D F 6-2353
WHITTEMORE W L 6-2391
WILCOX L 6-2409
WILHELM HARLEY A 6-2336
WISCONSIN UNIV 6-2342 6-2471
WITTENBERG LAYTON 6-2342
WOLFE R A 6-2356
WOLFGANG RICHARD L 6-2489
WORTHINGTON W J JR 6-2525
WOTIZ JOHN H 6-2348
WOUTERS L F 6-2498
WRIGHT AIR DEVELOPMENT CENTER 6-2424

YNGVE VICTOR H 6-2392
YOVITS M C 6-2519
YUAN LUKE C 6-2390
YUK JAMES P 6-2302

ZACHARIASEN W H 6-2411
ZATSEPIN G T 6-2402

NUMERICAL INDEX OF REPORTS

Numerical Index of Official Atomic Energy Reports with Indications of Their Availability

This list in the individual issues of Volume 6 supplements the Numerical Index of Reports with Indications of Their Availability which appears in NSA, Volume 5, No. 24. As reports are in manuscript form when abstracted for NSA, there may be some delay before the reports will be available at the Depository Libraries. The notation NSA in the Availability column indicates the appearance of a report in its entirety in NSA.

Abbreviations used below are:

NSA - NUCLEAR SCIENCE ABSTRACTS
ADD - ABSTRACTS OF DECLASSIFIED DOCUMENTS the predecessor of NSA
NNES - National Nuclear Energy Series, published by the McGraw-Hill Book Company

Code designations are assigned as follows:

MDDC - To declassified reports released by the Manhattan Engineer District and by the Atomic Energy Commission before March 1, 1948
AECD - To declassified reports released by the Atomic Energy Commission after February 29, 1948 (appeared in April 15, Nuclear Science Abstracts)
AECU - To unclassified reports originating within the Atomic Energy Project. (Subsequent to AECU-871, this code is applied only to reports carrying no other recognized code designation.)

Other code designations below are assigned to unclassified reports by the originating installations

Report	Abstract	Availability
AECD-2894	NSA 4-6724	J. Am. Chem. Soc. 74, 1191-4(1952)
3179	5-5420	$0.10
3250	5-6872	Phys. Rev. 85, 600-2(1952)
3260	5-7246	$0.10
3280	6-180	0.20
3305	6-1625	J. Phys. Chem. 56, 1-5(1952)
3318	6-2026	NSA
AECU-998	5-769	J. Am. Dental Assoc. 43, 664-84 (1951)
1315	5-4199	$0.20
1509	5-4800	Am. J. Roentgenol. Radium Therapy Nuclear Med. 67, 351-9(1952)
1613	5-6122	J. Am. Chem. Soc. 74, 1242-6(1952)
1636	5-6116	J. Am. Chem. Soc. 74, 1273-5(1952)
1708	6-111	Anat. Record 111, 509-10(1951)
1721	6-82	$0.10
1722	6-83	0.10
1758	6-826	J. Applied Phys. 23, 152-3(1952)
1759	6-986	Phys. Rev. 85, 643-52(1952)
1818	6-1176	J. Am. Chem. Soc. 74, 1343-4 (1952)
1825	6-1543	$0.20
1873	6-1947	NSA
1874	6-1989	NSA
1875	6-1945	NSA
1876	6-1946	NSA
1877	6-1980	NSA
AD-321(B)	5-4652	Am. J. Physiol. 167, 626-32(1951)
AERE-T/R-727	5-6889	Proc. Phys. Soc. (London) 65A, 101-9(1952)
BMI-77	5-5192	$0.10
BNL-1000	6-103	Nucleonics 10, No. 2, 33-5(1952)
1006	5-6952	Proc. Soc. Exptl. Biol. Med. 78, 571-3(1951)
1015	6-406	Nucleonics 10, 48-9(1952)
1018	6-503	J. Exptl. Zoöl. 118, 509-29(1951)
1025	6-1283	Phys. Rev. 85, 630-1(1952)
1035	6-1544	Phys. Rev. 85, 636-42(1952)
1052	6-1166	Phys. Rev. 85, 379-80(1952)
1056	6-1553	Phys. Rev. 85, 501-2(1952)
ISC-150	NSA 5-5312	J. Optical Soc. Am. 42, 42-9(1952)
KAPL-502	5-3670	J. Optical Soc. Am. 42, 37-41(1952)
NAA-SR-145	5-6040	Nucleonics 10, No. 2, 57-61(1952)
NP-3470	6-377	J. Applied Phys. 23, 78-82(1952)
3495	6-588	J. Electrochem Soc. 99, 13-15 (1952)
3547	6-1541	J. Applied Phys. 23, 53-65(1952)
NYO-639	6-384	$0.25
712	5-5830	Phys. Rev. 85, 530-1(1952)
898	6-337	Phys. Rev. 85, 563-9(1952)
901	5-5333	Phys. Rev. 85, 523-29(1952)
914	6-1771	Phys. Rev. 85, 371-2(1952)
970	5-5406	Phys. Rev. 85, 517-22(1952)
1635	6-50	Proc. Soc. Exptl. Biol. Med. 78, 489-90(1951)
3002	6-1305	Phys. Rev. 85, 489(1952)
3026	5-7285	Phys. Rev. 85, 416-23(1952)
3027	5-7282	Phys. Rev. 85, 424-6(1952)
3037	6-973	Phys. Rev. 85, 496-7(1952)
ORNL-486	4-2022	Nucleonics 10, No. 2, 36-9(1952)
1134	6-1288	$0.10
UCLA-107	5-2536	J. Optical Soc. Am. 42, 6-11(1952)
135	5-4057	J. Am. Pharm. Assoc. Sci. Ed. 41, 39-41(1952)
183	6-1702	J. Am. Chem. Soc. 74, 1109(1952)
UCRL-856	5-456	Phys. Rev. 83, 1-9(1951)
1080	5-2677	Experientia 7, 183(1951)
1179	5-4072	Arch. Biochem. Biophys. 32, 223-4(1951)
1200	5-4202	Rev. Sci. Instruments 22, 749-52 (1951)
1377	5-4505	Phys. Rev. 83, 855-6(1951)
1401	5-5035	Am. J. Physiol. 167, 775-6(1951)
1611	6-975	Phys. Rev. 85, 490-1(1952)
UR-146	5-2356	Am. J. Path. 28, 25-35(1952)
171	5-4351	Proc. Soc. Exptl. Biol. Med. 79, 97-9(1952)

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 1, page "SUPPLEMENT 1".

H	σ(10.0 ev) (lucite) 20.09 (polystyrene) 20.49	C. T. Hibdon, ANL-4602 (March 1951).
He	σ_s(thermal) 0.78	C. T. Hibdon, C. O. Muehlhause, ANL-4680 (Sept. 1951).
${}_{3}\mathrm{Li}^{7}_{4}$	Li^7(p,p) Resonances: 1.05, 1.88, 2.06	S. Bashkin, H. T. Richards, Phys. Rev. 84, 1124(1951).
${}_{4}\mathrm{Be}^{7}_{3}$	Li^6(p,p and p,α) Levels — Γ — J ~6.4 — large — ≤3/2 + 7.16 — 0.43 — 5/2 −	S. Bashkin, H. T. Richards, Phys. Rev. 84, 1124(1951).
${}_{6}\mathrm{C}^{12}_{6}$	$\mathrm{C}^{12}(\gamma,3\alpha)$ Be^8 intermediate?	R. Chastel, Compt. rend. 233, 1440(1951).
${}_{7}\mathrm{N}^{14}_{7}$	$\mathrm{C}^{13}(\mathrm{p,n})\mathrm{N}^{13}$ Resonances: 4.1, 4.9, 6.3 Threshold = 3.23	C. Eggenberger, P. Marmier, Helv. Phys. Acta 24, 323 (1951).
${}_{9}\mathrm{F}^{19}_{10}$	σ_s(thermal) 3.75	C. T. Hibdon, C. O. Muehlhause, ANL-4680 (Sept. 1951).
${}_{13}\mathrm{Al}^{26}_{13}$	τ 6.5^{s}	L. Katz, A. G. W. Cameron, Phys. Rev. 84, 1115(1951).
${}_{14}\mathrm{Si}^{30}_{16}$	γ's $\mathrm{Al}^{27}(\alpha,\mathrm{p})$ γ_1 2.32 γ_2 3.6 γ_3 1.28 γ_4 ~2.7 Coincidences $p_1\gamma_1$, $p_2\gamma_2$, $p_3\gamma_2$, $p_3\gamma_3$, $p_3\gamma_4$	R. C. Allen et al., Phys. Rev. 84, 1203 (1951).
${}_{15}\mathrm{P}^{31}_{16}$	σ_s(thermal) 4.67	C. T. Hibdon, C. O. Muehlhause, ANL-4680 (Sept. 1951).
Ti	σ_s(thermal) 3.96	C. T. Hibdon, C. O. Muehlhause, ANL-4680 (Sept. 1951).
	σ_t(3000 ev) 5.02	C. T. Hibdon, ANL-4602 (Mar. 1951).
Fe	σ_t(3000 ev) 7.00	C. T. Hibdon, ANL-4602 (Mar. 1951).
Co	σ_s(thermal) 8.34 σ_t(10.0 ev) 10.29 (19.5 ev) 8.52 (2700 ev) 4.09 (3000 ev) 4.55	C. T. Hibdon, ANL-4602 (Mar. 1951).
Ge	σ_t(10.0 ev) 5.13 (19.5 ev) 4.08 (120 ev) 4.93 (345 + 2400 ev) 4.01 (2700 ev) 2.54 (3800 ev) 4.47	C. T. Hibdon, ANL-4602(Mar. 1951).
As	σ_t(2700 ev) 7.35 (3000 ev) 6.77	C. T. Hibdon, ANL-4602 (Mar. 1951).
Zr	σ_t(19.5 ev) 6.23 (120 ev) 6.30 (345 + 2400 ev) 5.83 (2700 ev) 6.03 (3000 ev) 6.23	C. T. Hibdon, ANL-4602 (Mar. 1951).
${}_{41}\mathrm{Nb}^{91}_{50}$ 64^{d}	τ 62^{d} γ 0.105 K/L + M = 2.1	P. Preiswerk, P. Stähelin, Helv. Phys. Acta 24, 300 (1951).
${}_{41}\mathrm{Nb}^{92}_{51}$	K >99.95% β ≤0.05% γ >99.95% 0.930	P. Preiswerk, P. Stähelin, Helv. Phys. Acta 24, 300 (1951).
${}_{41}\mathrm{Nb}^{94}_{53}$	τ_2 $>5 \times 10^{4y}$	R. E. Hein et al., Phys. Rev. 85, 138 (1952).
${}_{41}\mathrm{Nb}^{95}_{54}$ 90^{h}	τ 80^{h} γ 0.232 sl;pe$^-$ K/L + M = 3.5	P. Preiswerk, P. Stähelin, Helv. Phys. Acta 24, 300 (1951).
${}_{41}\mathrm{Nb}^{96}_{55}$	τ 23^{h} β^- 8% 0.370 sl 92% 0.750 γ sl;ce$^-$ I(%) — E_γ — $\alpha \times 10^4$ 7 — 0.216 — <230 10 — 0.238 — <160 27 — 0.451 — 40 61 — 0.560 — 16 5 — 0.725? — ? 100 — 0.770 — 12 6 — 0.804 — 13	P. Preiswerk, P. Stähelin, Helv. Phys. Acta 24, 300 (1951).

	16 0.840 52 1.078 32 1.187	12 5.6 3.1		
$_{42}Mo^{100}_{58}$	σ(th n,γ)14.6^{m}Mo	0.23		V. Hummel, ANL-4659 (June 1951).
Ag	σ_s(thermal)	5.72		C. T. Hibdon, ANL-4602 (Mar. 1951).
$_{52}Te^{123}_{71}$ 90^{d}	$\gamma\gamma$ delay	$<10^{-9s}$		F. K. McGowan, Phys. Rev. 85, 142 (1952).
$_{52}Te^{125}_{73}$ 58^{d}	$\gamma\gamma$ delay	$<2 \times 10^{-9s}$		F. K. McGowan, Phys. Rev. 85, 142 (1952).
Nd	<0.02 α's/sec(gm of Nd) <0.003 β's/sec(gm of Nd)			G. I. Mulholland, T. P. Kohman, Phys. Rev. 85, 144(1952).
$_{60}Nd^{150}_{90}$	τ_β	$>2 \times 10^{15y}$		G. I. Mulholland, T. P. Kohman, Phys. Rev. 85, 144(1952).
$_{61}Pm^{148}_{87}$	τ_2 β^- γ	48^{d} 0.6 1.7 ~0.54	 a a	J. K. Long, M. L. Pool, Phys. Rev. 85, 137(1952). Nd^{148}(6 Mev p,n); rare earth chem.
$_{61}Pm^{150}_{89}$	τ β^-	2.7^{h} 2.4	 a	J. K. Long, M. L. Pool, Phys. Rev. 85, 137(1952). Nd^{150}(6 Mev p,n).
$_{63}Eu^{152}_{89}$ 9.2^{h}	γ	 0.1219 K/L ~ 4 0.3441 K/L ~ 10	sπ;ce$^-$ (Sm) (Gd)	H. B. Keller, J. M. Cork, Phys. Rev. 84, 1079(1951).
5.3^{y}	New assignment of γ's			
$_{63}Eu^{154}_{91}$ 5.4^{y}	New assignment of γ's			H. B. Keller, J. M. Cork, Phys. Rev. 84, 1079(1951).
$_{65}Tb^{160}_{95}$	(~0.9β)(0.085γ) delay	1.8×10^{-9s}		F. K. McGowan, Phys. Rev. 85, 142(1952).
$_{66}Dy^{165}_{99}$ 2.42^{h}	β(0.095γ) delay	$<0.8 \times 10^{-9s}$		F. K. McGowan, Phys. Rev. 85, 142(1952).
$_{68}Er^{171}_{103}$	γ 0.1128 K/L 0.1179 0.1255 0.1764 0.2946 0.3075 0.4197	~10 ~0.5 ~2 ~10 ~10	sπ; ce$^-$	H. B. Keller, J. M. Cork, Phys. Rev. 84, 1079(1951).
Hf	σ_t(10.0 ev) (120 ev) (345 + 2400 ev) (2700 ev) (3000 ev)	17.0 13.1 14.4 14.8 14.8		C. T. Hibdon, ANL-4602 (Mar. 1951).
W	σ_t(2700 ev) (3000 ev)	8.45 8.31		C. T. Hibdon, ANL-4602 (Mar. 1951).
Au	σ_s(thermal)	7.56		C. T. Hibdon, ANL-4602 (Mar. 1951).
$_{79}Au^{198}_{119}$	β(0.411γ) delay	$<0.4 \times 10^{-9s}$		F. K. McGowan, Phys. Rev. 85, 142(1952).
Hg	σ_s(thermal) σ_t(10.0 ev) (19.5 ev) (2700 ev) (3000 ev)	26.56 13.93 13.3 10.4 10.7		C. T. Hibdon, ANL-4602 (Mar. 1951).
$_{80}Hg^{203}_{123}$	β(0.28γ) delay	$<0.4 \times 10^{-9s}$		F. K. McGowan, Phys. Rev. 85, 142(1952).
$_{82}Pb^{210}_{128}$	β^- γ (0.0467γ)β^- $\gamma\gamma$ for E_γ = 16 to 30	0.018 0.0467	scin	R. C. Bannerman, S. C. Curran, Phys. Rev. 85, 134(1952).
$_{92}U^{238}_{146}$	σ(th n,f)	$<5 \times 10^{-4}$		R. L. Macklin, J. H. Lykins, J. Chem. Phys. 19, 844(1951).
$_{95}Am^{241}_{146}$	σ(pile n,γ)400^{y} Am^{242}	~50		K. Street, Jr. et al., Phys. Rev. 85, 135 (1952).
$_{95}Am^{242}_{147}$ ~16^{h}	σ(pile n,f)	~2000		K. Street, Jr. et al., Phys. Rev. 85, 135 (1952).
$_{95}Am^{242}_{147}$ ~400^{y}	σ(pile n,γ)Am^{243} σ(pile n,f)	~2000 ~6000		K. Street, Jr. et al., Phys. Rev. 85, 135 (1952).
$_{95}Am^{243}_{148}$	σ(pile n,f)	<40		K. Street, Jr. et al., Phys. Rev. 85, 135 (1952).

Q's Between Ground States

Li^6(t,d)Li^7 Li^6(t,p)Li^8	0.982 ± 0.007 0.784 ± 0.015	T. P. Pepper et al., Phys. Rev. 85, 155(1952).
O^{16}(d,α)N^{14} O^{16}(d,p)O^{17} F^{19}(d,α)O^{17} F^{19}(d,p)F^{20}	3.09 ± 0.02 1.93 ± 0.01 10.04 ± 0.02 4.39 ±	H. B. Burrows et al., Proc. Roy. Soc. (London) 209A, 478(1951).
Na^{23}(p,α)Ne^{20} Ne^{20}(d,p)Ne^{21} Ne^{22}(d,p)Ne^{23}	2.372 ± 0.008 4.529 ± 0.007 2.964 ± 0.007	D. M. Van Patter et al., Phys. Rev. 85, 142(1952); MIT Progress Report, Nov. 1951, 44.
Mg^{25}(d,α)Na^{23} Al^{27}(p,α)Mg^{24} Mg^{24}(d,p)Mg^{25} Mg^{25}(d,p)Mg^{26} Mg^{26}(d,p)Mg^{27} Si^{29}(d,α)Al^{27} P^{31}(p,α)Si^{28} P^{31}(d,α)Si^{29} Si^{29}(d,p)Si^{30} Si^{30}(d,p)Si^{31} P^{31}(d,p)P^{32}	7.019 ± 0.013 1.595 ± 0.007 5.097 ± 0.007 8.880 ± 0.012 4.207 ± 0.006 5.994 ± 0.011 1.909 ± 0.010 8.158 ± 0.011 8.388 ± 0.013 4.364 ± 0.007 5.704 ± 0.008	D. M. Van Patter et al., Phys. Rev. 85, 142(1952); MIT Progress Report, Nov. 1951, 44.

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